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UNIVERSITY OF PENNSYLVANIA

# Experimental Research As a Factor In Commercial Education

BY

FRANK HENRY KRAMER

A THESIS

PRESENTED TO THE FACULTY OF THE GRADUATE SCHOOL IN PARTIAL  
FULFILMENT OF THE REQUIREMENTS FOR THE DEGREE OF  
DOCTOR OF PHILOSOPHY

THE SOMERVILLE PUB. CO.  
SOMERVILLE, N. J.

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EXCHANGE









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# EXPERIMENTAL RESEARCH AS A FACTOR IN COMMERCIAL EDUCATION

## INTRODUCTION

In the last five or ten years considerable thought has been given to the matter of experimental research in a number of the subjects taught in our schools. Compared with what has been done in other fields, very little scientific study has been given to the commercial subjects. It is with the hope that such study may be increased, that this thesis is attempted.

Experimental Research in Education itself is as yet an experiment. Its procedures are in process of development. It has not even reached the stage where it has convinced everyone that it is worth while. In fact, it will take considerable time to cast off the opprobrium which has been heaped upon its head. Much of this negative attitude is due, not to real scientific experimentation, but to pseudo-scientific experimentation.

Experimenters in their enthusiasm have not been careful to be truly scientific. They have offered, as valid, experiments which have failed to observe the most ordinary scientific precautions. They have presented and interpreted with statistical exactness data which in itself has been worthless. They have read into the results unwarranted conclusions. Persons outside of the field of experimental research saw these weaknesses and formed an unfavorable opinion of all work conducted in that field.

But there is no reason why truly scientific experiments should not be conducted in educational lines as well as in other fields. It is true that, in dealing with human beings, it is harder to maintain the uniform conditions essential to valid research, than it is in dealing with some clearly defined combination in chemistry. But, if we can isolate the factors we want to test, there is no reason why we cannot get good results. Even with the little work done in this field up to the present time, some reliable conclusions have been reached. With each rigidly scientific experiment, those which follow become easier. Mr. Edison did not succeed with his incandescent electric lamp until after his thousandth attempt, and his experiments with the alkaline storage battery ran up to tens of thousands before he was satisfied with the commercial type of battery. If success comes so slowly in the well-established field of the physical sciences,

workers in the comparatively new field of applied mental science must not become disheartened at tedious hours and small results.

Since educational research is a new phase of science, since the commercial subjects have but recently come into our public school curriculum, and since there are not many scientifically minded teachers of these subjects, it is hardly to be expected that very much research work has been done in determining effective methods of teaching in this field.

An ideal outline for a thesis on the subject in mind would be the following:

Part I. WHAT HAS BEEN DONE IN THIS FIELD AND  
WHAT IS NOW UNDER WAY OR CON-  
TEMPLATED.

Part II. WHAT REMAINS TO BE DONE.  
a. A LIST OF THE PROBLEMS.  
b. A SOLUTION FOR EACH PROBLEM.

Something approaching a satisfactory treatment of Part I is possible, and, therefore, it will be included in the outline that will be adopted.

But it is much more than one man's task to work out Part II. It is unwise to pronounce finality on a subject of this kind, because it will always be possible to find someone else who has thought of a problem that has never entered one's own mind. To conceive all the problems in this field would be impossible, and it seems hardly necessary to argue the point.

But even if a list of all the problems in the field could be obtained, it would be out of the question to find a solution for everyone of them, and, if it were possible to find the solutions, this would obviously be the work of more than one person.

Hence, to use this ideal outline would be to attempt the impossible, and, with this thought in mind, the outline will be modified by choosing several of the more strictly commercial subjects, stating some typical problems in each of them, and suggesting a method of procedure for experimentation along these lines.

This thesis then will have two main parts as above, but modified as follows:

PART I.  
WHAT HAS BEEN DONE IN THIS FIELD AND  
WHAT IS NOW UNDER WAY OR CONTEM-  
PLATED.

## PART II.

SOME TYPICAL PROBLEMS THAT REMAIN  
UNSOLVED IN SOME OF THE MORE STRICT-  
LY COMMERCIAL SUBJECTS, AND

A SUGGESTED METHOD OF PROCEDURE  
FOR EXPERIMENTATION ALONG THESE  
LINES.

PART I contains an exhaustive list of the efforts made in Commercial Education to solve problems by experimenting. Attempts have been included that are not scientific, as well as those that are, for the reason that the purpose of this thesis is a practical one, and, even though an experiment may not be scientific, it may contain suggestions which may help someone who is trying to solve the same problem scientifically. It may do no more than point out the things to be avoided when the experiment is tried again, but this is sufficient ground for including it.

In PART II no attempt has been made to state all that remains to be done either in the listing of the problems in the commercial field that are not settled, or in the developing of methods of procedure to solve these problems. A few outstanding commercial subjects have been selected and the procedure for typical experiments in these subjects will be suggested. The methods suggested are not given as absolutely valid methods. That judgment cannot be pronounced upon them until after they have been tried out thoroughly. Care has been taken in thinking them out, but anyone who has spent some time in a seminar where work of this kind is conducted knows only too well that, even with 15 or 20 persons passing judgment upon the validity of the method, it is possible to overlook some important details which are not discovered until after the experiment has been completed.

This thesis is written as pioneer work in commercial studies and is therefore likely to have all the shortcomings that we find in such work.

It is earnestly hoped that a considerable number of commercial teachers will, before long, become interested in this line of work and that, by criticising, improving, expanding, and testing the methods presented, they will make it possible to build up a body of scientific data for teaching commercial subjects.

## PART I

### WHAT HAS BEEN DONE IN THIS FIELD AND WHAT IS NOW UNDER WAY OR CONTEMPLATED

A thesis on this subject should contain a complete bibliography of the experiments already conducted in the field. To this end a careful search has been made of the

Monthly Record of Current Educational Publications, U. S. Bureau of Education

Reader's Guide to Periodical List

Reports of Educational Associations

and books of the type of the following:

Mind in the Making, Swift

Principles & Methods in Commercial Education, Kahn & Klein

Principles of Teaching, Thorndike

Educational Psychology, Thorndike

Psychology of Learning, Thorndike

The Army Trade Tests

Vocational Psychology, Hollingworth

Survey of the Needs in Commercial Education, Rochester Chamber of Commerce

Experiments in Educational Psychology, Starch

Methods of Teaching in High School, Parker

The American High School, Brown

High School Education, Johnston et al.

Psychological Principles of Education, Horne

In addition to this, letters asking for a bibliography of educational experiments in commercial subjects and for information concerning such experiments under way or contemplated were addressed to a number of institutions and individuals who would be likely to have information on the matter, among them:

The Congressional Library

Pennsylvania State Library

U. S. Bureau of Education

Carnegie Institution of Washington

Carnegie Foundation for the Advancement of Teaching

General Education Board

Russell Sage Foundation

Pan-American Scientific Congress

National Associated Schools of Scientific Business

Director of Cleveland Educational Survey

National Society for the Promotion of Industrial Education



Women's Industrial & Educational Union  
Division of Reference & Research, Department of Education, The  
City of New York  
Department of Educational Investigation & Measurement, The  
School Committee of the City of Boston  
Bureau of Experimental Research, New York City  
Chamber of Commerce, Boston  
Chamber of Commerce, Cleveland  
Chamber of Commerce, Chicago  
Chamber of Commerce, Rochester  
F. V. Thompson, Asst. Supt. of Schools, Boston  
Cheesman A. Herrick, Pres., Girard College  
Miss Bertha M. Stevens, Secy. of Educational Committee, New  
York City  
Rochester Bureau of Efficiency, Board of Education, Rochester,  
N. Y.  
Director of Research & Efficiency, Board of Education, Kansas  
City, Mo.  
New Orleans Dept. of Education & Research, Board of Education,  
New Orleans, La.  
Detroit Dept. of Education & Research, Board of Education, De-  
troit, Mich.

Negative answers were received from the following, stating that they could furnish no such bibliography or knew of no experiments:

The Congressional Library  
Pennsylvania State Library  
U. S. Bureau of Education  
Carnegie Institute of Washington  
General Education Board  
The Survey Committee of The Cleveland Foundation  
National Society for the Promotion of Industrial Education  
Division of Reference & Research, Dept. of Education, The City  
of New York  
Department of Educational Investigation & Measurement, The  
School Committee of the City of Boston  
Joseph P. O'Hern, Asst. Supt., Dept. of Public Instruction, Ro-  
chester, N. Y.  
Geo. Melcher, Director Bureau of Research & Efficiency, Kansas  
City, Mo.

Several did not reply (at least, the reply was not received) and most of the others furnished no information that proved to be what was wanted.

A letter, asking for a list of the experiments conducted in commercial branches, was sent to a number of Schools and Departments of Education of the higher educational institutions in the United States and Canada; also to the Department of Psychology of several of the universities where

the experimentation is carried on by that department rather than by the Department of Education. The letter was also sent to a number of individuals who are authorities on experimental education.

The letter sent, read as follows:

UNIVERSITY OF PENNSYLVANIA,

Philadelphia, Pa., March 18, 1918.

DEAR SIR: As a basis for further experimentation on efficiency in the teaching of the commercial branches, I am compiling a bibliography of experiments bearing upon that field, including Stenography, Typewriting, Bookkeeping, Rapid Addition, Commercial Arithmetic, Commercial Geography, Commercial Law, Economics, Advertising, Business English and Penmanship.

Will you have some one send me a list of the experiments along this line, made or to be made at your university,—printed or unprinted. In the event that there is nothing to report, I would appreciate word to that effect. If you wish it, I will, in return, send you a list of the experiments reported to me.

Yours very truly,

It was sent to the following:\*

University of Alabama  
 University of Arizona  
 University of Arkansas  
 University of California  
 Pomona College  
 University of Southern California  
 University of Redlands  
 College of the Pacific  
 University of Santa Clara  
 Leland Stanford Junior University  
 University of Colorado  
 University of Denver  
 Yale University  
 Delaware College  
 Catholic University of America  
 George Washington University  
 Howard University  
 John B. Stetson University  
 University of Florida  
 University of Georgia  
 Atlanta University  
 Mercer University  
 University of Idaho  
 Illinois Wesleyan University  
 De Paul University  
 University of Chicago

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\*Listed alphabetically by states, per Educational Directory of the U. S. Bureau of Education.

James Millikin University  
Northwestern University  
University of Illinois  
Indiana University  
Indiana Central University  
Purdue University  
Iowa State College of Agriculture & Mechanic Arts  
Iowa State Teachers College  
Drake University  
Central University of Iowa  
Baker University  
Kansas City University  
University of Kansas  
Friends University  
State University of Kentucky  
Louisiana State University & Agricultural & Mechanical College  
H. Sophie Newcomb Memorial College (Tulane Univ.)  
Bowdoin College  
Bates College  
University of Maine  
Johns Hopkins University  
Western Maryland College  
Boston University  
Simmons College  
Harvard University  
Radcliffe College  
Smith College  
Mount Holyoke College  
Wellesley College  
Clark University  
University of Michigan  
University of Detroit  
University of Minnesota  
Carleton College  
Hamline University  
Mississippi College  
University of Missouri  
Washington University  
University of Montana  
University of Nebraska  
Graduate School of Education, Creighton University  
University of Omaha  
Nebraska Wesleyan University  
State University of Nevada  
Dartmouth College  
Rutgers College  
University of New Mexico  
New York State College for Teachers  
Alfred University  
Colgate University

## EXPERIMENTAL RESEARCH

Cornell University  
College of the City of New York  
New York University  
Teachers College  
University of Rochester  
Syracuse University  
University of North Carolina  
Shaw University  
University of North Dakota  
Ohio University  
University of Cincinnati  
Ohio State University  
Ohio Wesleyan University  
Oberlin College  
Miami University  
Otterbein University  
University of Oklahoma  
University of Oregon  
Pacific University  
Willamette University  
University of Pittsburgh  
University of Porto Rico  
Brown University  
University of South Carolina  
Dakota Wesleyan University  
University of South Dakota  
University of Chattanooga  
University of Tennessee  
University of Texas  
Southwestern University  
Baylor University  
University of Utah  
University of Vermont & State Agricultural College  
Middlebury College  
University of Virginia  
Randolph-Macon Women's College  
University of Washington  
West Virginia University  
University of Wisconsin  
University of Wyoming  
University of Toronto  
McGill University

Replies were received from the following:

University of Alabama  
University of Arizona  
University of Arkansas  
Pomona College

University of Santa Clara  
Leland Stanford Junior University  
University of Colorado  
University of Denver  
Yale University  
Delaware College  
Catholic University of America  
George Washington University  
Atlanta University  
University of Chicago  
University of Illinois  
Indiana University  
Purdue University  
Iowa State College of Agriculture & Mechanic Arts  
Kansas City University  
University of Kansas  
H. Sophie Newcomb Memorial College (Tulane Univ.)  
Bates College  
Johns Hopkins University  
Boston University  
Simmons College  
Harvard University  
Clark University  
University of Michigan  
University of Detroit  
University of Minnesota  
Nebraska Wesleyan University  
Dartmouth College  
Rutgers College  
University of New Mexico  
Alfred University  
Colgate University  
Cornell University  
College of the City of New York  
New York University  
Teachers College  
Shaw University  
University of North Dakota  
Ohio University  
University of Cincinnati  
Ohio State University  
Ohio Wesleyan University  
Oberlin College  
Otterbein University  
University of Porto Rico  
University of South Carolina  
Dakota Wesleyan University  
University of South Dakota  
University of Chattanooga

University of Tennessee  
University of Texas  
Southwestern University  
University of Utah  
University of Vermont & State Agricultural College  
Middlebury College  
University of Virginia  
Randolph-Macon Women's College  
University of Washington  
University of Wisconsin  
University of Wyoming  
University of Toronto  
McGill University

The following had nothing to report :

University of Alabama  
University of Arizona  
University of Arkansas  
Pomona College  
University of Santa Clara  
Leland Stanford Junior University  
University of Denver  
Yale University  
Delaware College  
Catholic University of America  
Atlanta University  
University of Illinois  
Purdue University  
Iowa State College of Agriculture & Mechanic Arts  
Kansas City University  
University of Kansas  
H. Sophie Newcomb Memorial College ( Tulane Univ. )  
Bates College  
Simmons College  
Harvard University  
Clark University  
University of Michigan  
University of Detroit  
University of Minnesota  
Nebraska Wesleyan University  
Dartmouth College  
Rutgers College  
University of New Mexico  
Alfred University  
Colgate University  
Cornell University  
College of the City of New York  
Shaw University

University of North Dakota  
 Ohio University  
 Ohio State University  
 Ohio Wesleyan University  
 Otterbein University  
 University of Porto Rico  
 University of South Carolina  
 Dakota Wesleyan University  
 University of Chattanooga  
 University of Tennessee  
 University of Texas  
 Southwestern University  
 University of Utah  
 University of Vermont & State Agricultural College  
 Middlebury College  
 University of Virginia  
 Randolph-Macon Women's College  
 University of Washington  
 University of Wisconsin  
 University of Wyoming  
 University of Toronto  
 McGill University

## SUMMARY

|  |     |
|--|-----|
| Schools written to .....                 | 120 |
| Answers received .....                   | 67  |
| Schools that had nothing to report ..... | 56  |
| Schools that did not reply .....         | 53  |

The present investigation has disclosed the following experiments:\*

## TYPEWRITING

William Frederick Book, "The Psychology of Skill with Special Reference to Its Acquisition in Typewriting." Montana University Publications, 1908.

A very elaborate piece of work. Its aim was to obtain a practice or learning curve and to obtain from self-observations and objective records, data to explain the curves. 11 subjects took part in the experiment.

Frederic Lyman Wells, "On the Psychomotor Mechanisms of Typewriting," American Journal of Psychology, Jan., 1916, Vol. XXVII pp. 47-70.

Its aim was to inquire into increasing the efficiency of typewriting on the psychological side. Two subjects took part.

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\*The search was not confined to the subjects mentioned in the letter on p. 6.

Clark University reported that Prof. (then Major) M. E. Haggerty of the University of Minnesota had obtained some valuable results on the teaching of typewriting.

Simmons College reported that Mr. Tullos of Harvard University had recently been conducting some investigations on the work in typewriting and telegraphy in their classes.

George Washington University, Dr. Ruediger reported that one of his graduate students, Mrs. Daisy I. Huff was working on her master's essay on the subject of teaching Shorthand and Typewriting. It had not been completed.

Hill, Rejall & Thorndike, on "Practice in the case of Typewriting" Pedagogical Seminar, Dec. 1913, Vol. XX, pp. 516-529.

William A. Cook, University of Colorado, reported an experiment he had under way to map the curve of progress from month to month, with the ultimate establishment of norms in mind.

University of Chicago reported three unpublished theses (masters) by C. L. Kjerstad, "An Experimental Study of the Form and Fluctuations of Learning Curves of Typewriting."

C. G. Bradford, "Experiments in Typewriting," Pedagogical Seminar, Vol. XXII, pp. 445-460. Four subjects took part in this experiment.

#### SHORTHAND

William A. Cook, University of Colorado, reported that he also had under way an experiment in stenography.

George Washington University, Dr. Ruediger, reported that one of his graduate students, Mrs. Daisy I. Huff, was working on her master's essay on the Teaching of Shorthand and Typewriting. It had not been completed.

University of Texas reported that Miss Ina Thomas, Secretary of the National Commercial Teachers Association, had recently made some experiments in stenography.

#### COMMERCIAL ARITHMETIC

University of Chicago reported three unpublished master's theses by Geo. Amos Beers, "Tests of various methods of drill in Commercial Arithmetic."

Paul H. Hanus and K. D. Gaylord, "Courtis Arithmetic Tests applied to Employees in Business Houses." Educational Administration and Supervision, Nov. 1917.



## ADVERTISING

Hollingworth, "The Psychology of Advertising and Business Practice."  
Reported by Dr. Thorndike, Teachers College.

R. H. Stetson, "The Optimal Size of Type for Advertising Headlines."  
Reported by Oberlin College.

## MISCELLANEOUS

University of North Dakota reported that Prof. Joseph Kennedy would have a short article for the School of Education Record suggesting experimentation along different lines in the schools of the state.

Johns Hopkins University reported that Miss Flora D. Sutton had made a very interesting study on failures in different subjects of students in four different high schools.

In searching through the Monthly Record of Current Educational Publications, of the U. S. Bureau of Education, a considerable list of material on Handwriting and Spelling was found. These are not strictly commercial subjects, but it was thought advisable to include the list, though it was not deemed necessary to give an evaluation, as they have no particular bearing on the experiments under consideration.

The list is as follows:

## HANDWRITING

1913—Journal of Educational Psychology, Nov. 1912. The Writing Abilities of the Elementary & Grammar School Pupils of a City School System, Measured by the Ayres Scale.

Journal of Educational Psychology, Oct. 1913. Starch. The Measurement of Handwriting.

1914—School & Home Education, April 1914. Helps from the Use of Standard Scales of Attainment in School Subjects. Writing.

Elementary School Journal, Nov. 1914. School Subjects as Material for Tests of Mental Ability. Writing.

Journal of Educational Psychology, Nov. 1914. A Comparison of the Ayres and Thorndike Handwriting Scales.

American School Board Journal, May, 1914. A Method of Measuring Handwriting. Witham.

1915—Starch. The Measurement of Efficiency in Reading, Writing, Spelling and English. The College Book Store, 1914, Madison, Wisconsin.

Elementary School Journal, Jan. 15. The Use of an Objective Scale for Grading Handwriting.

Journal of Educational Psychology, Feb. 15. Starch, The Measurement of Efficiency in Handwriting.

Journal of Educational Psychology, Feb. 1915. Training of Judgment in the Use of the Ayres Scale for Handwriting.

Starch. Journal of Educational Psychology, Mar. 1915. The Measurement of Efficiency in Spelling and the Overlapping of Grades in Combined Measurements of Reading, Writing and Spelling.

Elementary School Journal. 1915 April. An Analytical Scale for Judging Handwriting. Freeman.

School & Society. Oct. 30, 1915. An application and Critique of Ayres Handwriting Scales.

National Society for the Study of Education, 14th Year Book. Handwriting, F. N. Freeman. Univ. of Chicago Press.

Russell Sage Foundation. Ayres. A Scale for Measuring the Handwriting of Adults.

Teachers College Record, Vol. XV, No. 5. Teachers' Estimates of the Quality of Specimens of Handwriting. Thorndike.

Educational Administration & Supervision, May, 1915. A Means of Measuring School Achievement in Handwriting. Thorndike.

Educational Administration & Supervision, May, 1915. All the Elements of Handwriting Measured. Witham.

1916—Elementary School Journal. Feb. 1916. Measuring quality of Handwriting.

Elementary School Journal. Feb. 1916. Handwriting tests for use in school surveys. Freeman.

Journal of Educational Psychology. Oct. 1916. A study in Handwriting.

James H. Harris. Supt. of Schools, Dubuque, Ia. A study of handwriting in the public schools of Dubuque, Iowa.

Journal of Educational Psychology, Nov. 1912. Writing Abilities of Elementary and Grammar School Pupils of the City School system by the Ayres Scale.

1917—N. Carolina High School Bulletin, Oct. 1916. A comparison of Ayres and Thorndike Handwriting Scales.

Educational Administration and Supervision. Nov. 1916. A Comparison of Writing, Spelling and Arithmetic Abilities, of the Country and City Children.

Elementary School Journal. Rhythm in Handwriting. Feb. 1917.

Measuring and Standardization of Handwriting in a School system. Elementary School Journal, March 1917.

1918—A. N. Palmer Co. New York City. 8 leaflets. Standards for the valuation of Efficiency in Palmer methods of Handwriting.

Elementary School Journal, Feb., 1918. The Determination of Ultimate Standards of Quality in Handwriting in the Public School.

Elementary School Journal, Feb. 1918. The Comparative Accuracy of the Ayres Handwriting Scale, Gettysburg Edition.

Journal of the N. Y. State Teachers' Assn., March 1918. Penmanship Scales—Their Merits and Limitations.

Elementary School Journal, June 1918. The Results of Some Classroom Measurements. (Portsmouth, N. H., Schools).

Zaner & Bloser, Columbus, Ohio. 1917 (?). Handwriting Measurements, Standards and Methods. Report and Results of Chillicothe, Ohio, Surveys in Writing.

Elementary School Journal, Sept. 1918. The Use of a Score Card in Measuring Handwriting.

Louisiana Dept. of Ed. Bulletin No. 1, June 1918. Report on Spelling and Penmanship in Country Schools.

Journal of Educational Psychology, Oct. 1918. An Analytic Scale of Handwriting.

Bulletin of the Northern Normal & Industrial School. Oct. 1918. Reading, Writing, Arithmetic, and Spelling in the City and Town Schools of South Dakota in 1917-18.

1919—Business Education. Dec. 1918. Some Measurements in Commercial Education.

Pittsburgh Board of Pub. Ed. Research & Measurement Bulletin No. 3. Writing Test, June 4, 1918.

Journal of Educational Psychology, Apr. 1919. The Effect of Exempting Pupils Proficient in Handwriting.

School & Society, Feb. 18, 1919. Starch. A Scale for Measuring Handwriting.

Boston. Dept. of Educational Investigation & Measurement. Bulletin No. 17. Organization & Administration of the Intermediate Schools of Boston.

Wisconsin State Dept. of Education Bulletin No. 1, Studies in Educational Measurement. 1916-17. Report on the Use of Some Standard Tests.

#### SPELLING

1913—Ayres Spelling Vocabularies of Personal & Business Letters. Russell Sage Foundation. Pamphlet E-126.

Va. Journal of Education, Dec. 1912. An Experiment in Spelling.

Education, Sept. 1913. A Review of Pedagogical Studies in the Teaching of Spelling. (Describes the different tests.)

Teachers College Contributions to Education, No. 59. B. R. Buckingham. Spelling Ability; Its Measurement and Distribution, 1913.

1914—Journal of Educational Psychology, Oct. 1914. Further Experimental Research on Learning to Spell.

School World, Nov. 1913. Report of an Investigation into Spelling. Experiment at Manchester, England.

Journal of Educational Psychology, Nov. 1913. Experimental Researches on Learning to Spell.

1915—Starch. The Measurement of Efficiency in Reading, Writing, Spelling and English. The College Book Store, 1914, Madison, Wis.

Starch. Journal of Educational Psychology, Mar. 1915. The Measurement of Efficiency in Spelling and the Overlapping of Grades in Combined Measurements of Reading, Writing and Spelling.

Pedagogical Seminary, Sept. 1915. Critical Study of Rice's Spelling Efficiency Investigation.

School and Society, Oct. 9 and 16, 1915. Spelling Efficiency in the Oakland Schools.

Russell Sage Foundation. Ayres. A Measuring Scale for Ability in Spelling.

North Carolina High School Bulletin, Apr. 1915. High School Pupils Tested on Spelling.

National Society for the Study of Education. 14th Year Book. Spelling, H. C. Pryor. Univ. of Chicago Press.

Educational Administration & Supervision, May 1915. A Means of Measuring School Achievements in Spelling. Thorndike.

1916—Popular Educator, Dec. 1915. Tacoma Spelling Survey. E. E. Crook, Supt. of Schools, Tacoma, Wash.

Elementary School Journal, Dec. 1915. The Relation of Spelling Ability to General Intelligence and to Meaning Vocabulary.

Oakland, Calif., Board of Education 1915. Bur. of Inf., Stat., & Ed. Res. Publication. Spelling Efficiency in the Oakland Schools. Report of the Oakland Spelling Investigation of Oct. 1914.

School & Society, Dec. 18, 1915. Measuring a School System by the Buckingham Spelling Scale.

Elementary School Journal, Mar. 1916. Measuring Progress. Wichita, Kansas, Spelling Tests.

Journal of Educational Psychology. Feb. 1916. Additional Researches on Learning to Spell.

A Descriptive & Critical Study of Buckingham's Investigation of Spelling Efficiency. Educational Administration & Supervision May 1916.

Elementary School Journal, June 1916. Testing the spelling abilities of Iowa School Children by the Buckingham Test.

J. W. Studebaker Spelling; Results of an Investigation of pupils' ability to spell. Newson & Co., N. Y. 1916.

Midland Schools. Sept. 1916. The Relation Between Spelling Judgment and Spelling Ability.

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## PART II

### SOME TYPICAL PROBLEMS THAT REMAIN UNSOLVED IN SOME OF THE MORE STRICTLY COMMERCIAL SUBJECTS AND A SUGGESTED METHOD OF PROCEDURE FOR EXPERIMENTATION IN THESE LINES

From PART I it will be seen that the commercial education field is still open for much research work along experimental lines.

In accordance with the plan laid down in the introduction, a few of the strictly commercial subjects have been chosen and an effort has been made to develop a method of procedure for some typical experiments in these subjects.

The subjects chosen are :

Typewriting  
Shorthand  
Bookkeeping

Some typical problems, remaining unsolved in these subjects, are the following :

#### TYPEWRITING

1. Does emphasizing speed in typewriting interfere with accuracy, and, if so, to what extent?
2. The age at which it is most economically advantageous for a person to begin the study of typewriting.
3. The production of a typewriting norm.
4. Should we teach the Touch Method or the Sight Method of Typewriting in our schools?
5. Should the schools have open or blank keyboards on the typewriters used for instruction purposes?

#### STENOGRAPHY

1. The number of presentations necessary to fix an outline.
2. The number of ideas that can be presented in a lesson.
3. Intervals of repetition.



4. A method for determining those unfit for high speed in shorthand.
5. Forearm vs. finger movement in shorthand.
6. The drill that would be most valuable to shorthand students.
7. The proportion of time that should be spent in reading back notes.

#### BOOKKEEPING

1. Gradation in mastery.
2. Use of suggesters.
3. The use of forms vs. the use of only the text book, in bookkeeping.

#### FORM USED IN WRITING UP THE EXPERIMENTS

In writing up the method of procedure for the experiments just listed, it was thought wise to follow the outline used in the Pedagogical Seminar conducted by Dr. A. Duncan Yocum at the University of Pennsylvania. This outline was developed in the Seminar under Dr. Yocum's direction and was formulated by Dr. Ambrose H. Suhrie, a former member of the Seminar.

As will be seen from the outline, it has been planned for use in a seminar. It covers every step in an experiment, from the time the problem is first conceived until the experiment is completed, and the results are printed and distributed. Since the experiments herein given are not being presented to a seminar, certain portions of the outline will, of course, be omitted in the treatise and a few slight modifications will be made to suit the needs of presenting the subject outside of a seminar.

It was thought well to use this outline:

Because it is a good one and seems to answer the purpose satisfactorily.

Because it has been used in writing up a number of experiments and is familiar to a number of students in this field of work; therefore, they would know just where to look for any particular details of an experiment in which they are interested.

Because in these days of standardization, the value of a standard outline for experiments of this kind will be appreciated.

The outline worked out in Dr. Yocum's Seminar and written up by Dr. Suhrie is given below:†

## I. FORMULATION OF A PROBLEM FOR EXPERIMENTATION. (*Formulation*)§

### 1. Introduction.

- a. A statement in very general terms of some controverted point or of some unsolved problem in educational method. (*General Statement*).
  - b. A brief survey of experiments made in the same general field for the scientific determination of the value of factors in educational method, and a summary of results. (*Survey of Experiments Made*).
  - c. Differentiation of problem proposed from any or all others attempted in the same general field—or a brief statement of reasons for resubmitting a problem to test. (*Differentiation*) or (*Reasons for Resubmitting*).
2. Specific statement of problem so worded as to clearly define the field of the experiment and isolate the factor to be tested. (*Specific Statement*).

## II. SELECTION OF LABORATORY FOR EXPERIMENTS. (*Selection of Laboratory*)

1. Grades or Groups of Pupils selected and a statement of reasons for the particular choice. (*Groups Chosen*).
  2. Schools chosen—because of:\* (*Schools Chosen*).
- a. General character of student body—describe.
  - b. Accessibility to experimenter.

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†See "The Inductive Determination of Educational Methods" by Ambrose L. Suhrie, published by Warwick & York, Inc., Baltimore, Md.

§The headings in parenthesis and italics are not those of Dr. Suhrie but of the writer. For the sake of brevity, these will be used in the experiments which follow, instead of the very complete headings Dr. Suhrie has given.

\*Dr. Suhrie's outline reads:

2. Schools chosen—because of:
  - a. Ideal external conditions.
    - (1) General character of student body—describe.
    - (2) Accessibility to experimenter.
  - b. Co-operation of supervisory officers—reasons for assuming this.

- c. Co-operation of all concerned—reasons for assuming this.
- d. Any other reasons.
- 3. Teacher in charge of grades or groups. Selected because: (*Teachers in charge*).
  - a. Intelligent with reference to controlling conditions of test, in co-operation with experimenter or investigator. Precautions taken to insure this.
  - b. His scientific attitude of mind. Reasons for believing this.
  - c. Professionally interested in results of test.
  - d. Any other reasons.\*

### III. CHOICE OF CONDUCTOR OF EXPERIMENT. (*Choice of Conductor*)

- 1. A consideration of each of the following agents or any combination of them collaborating as best adapted to the purposes of the experiment and most likely to secure valid results.
  - a. The investigator—why or why not?
  - b. The teacher in charge of the grade or group—why or why not?
  - c. The principal in charge of a building—why or why not?
  - d. The superintendent in charge of a system—why or why not?
  - e. Anyone else—why or why not?\*
- 2. The agent (or agents) selected as determined by: (*Agent selected*).
  - a. Ideal desirability.
  - b. Expediency.
  - c. Necessity.

### IV. DEVELOPMENT OF A PROCEDURE FOR EXPERIMENT. (*Development of Procedure*)

- 1. Content—should include a full consideration of: (*Content*).

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\*Added by the writer.

(General plan briefly stated.)‡

- a. Difficulties encountered and plans for overcoming them. (*Difficulties*).

- (1) †Tests—pre-preliminary  
preliminary  
equalization  
final

- (2). Preliminary conferences with school officials and teachers.

- (3). Any other difficulties.\*

- b. Dates and days on which instruction, drills or tests are to be given. (*Time*).

- c. Time of day when presentations, drills or tests are to be given. (*Period*).

- d. Subject-matter to be used as basis of instruction, drills or tests. (*Subject-matter*).

- e. Details of procedure proposed for experimenter or his assistants in conducting the experiment. For example: (*Details of procedure*).

(Details in general.)§

- (1). Copies of instruction to be given to helpers with statement of precautions to be observed.

- (2). Time limits fixed for periods of instruction, drills or tests—with precautions to be observed.

- (3). Form, order, and method of giving directions to group to be tested. Precautions to be observed.

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‡The writer finds that, for the purpose of this thesis, it would be well, in the case of some experiments, to include such a plan at this point.

†Altered by the writer to suit his particular needs in this thesis.

Dr. Suhrie's outline is:

- (1). Preliminary tests to find: (a) the "unknown," (b) disturbing factors, (c) suitable subject-matter, (d) time limits, (e) suitable laboratory, (f) etc.

\*Added by the writer.

§Inserted by the writer to meet the needs in some of the experiments given in this thesis.

(4). Record to be made of:

- (a). interruptions to attention of class or of any considerable number of students (in some cases of even only one or two)\* by visitors, messengers, storm or rain, accident, discipline, etc.;
- (b). weather conditions during each successive period of presentations, drills or tests;
- (c). temperature of laboratory (classroom);
- (d). condition of ventilation;
- (e). missteps in carrying out instructions by slight or considerable variations in form of a definitely planned procedure, as, for instance, the inversion of order or the varying pronunciation of words.

2. Form—A statement in full detail and in order of steps to be taken in the preparation and presentation of material of test and in full conduct of experiment. (*Form*).

#### V. CONDUCTING OF EXPERIMENT. (*Conducting of Experiment*)

1. Under conditions agreed upon with such slight modifications only as are made necessary by exigencies of a given situation.
2. Full, detailed, and explicit record—at the time—of all variations from approved procedure, together with any observations which might introduce varying factors.

#### VI. REVIEW OF EXPERIMENT AND PRELIMINARY REPORT. (*Preliminary Report*)

1. A full statement by experimenter and assistants—in person, when possible—to Seminar of all information, whether recorded or not, which has bearing direct or remote, upon interpretation of results and validity of same.
2. Tentative outline of scheme for tabulation of data with suggestions—possible or significant correlations to be found, diagrams to be made, and points to be emphasized in formal report for publication.

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\*Added by the writer.

VII. FORMAL REPORT AND PUBLICATION. (*Formal Report*)

1. Preparation of report by individual or committee.
2. Principles governing form of report as determined by the uses to which it is to be put.
  - a. The abstract
  - b. The summary
  - c. The detailed report
3. Review, criticism, and, if need be, complete or partial revision by Seminar.
4. Dissemination of the several kinds of reports by most effective and economical means, so as to hasten the development of a science of educational method and favorably affect current educational practice.

A development of the outline just given is next in order, but, before proceeding with this, it might be well to make a few remarks on educational experimentation in general, to afford a viewpoint to those who are unfamiliar with this field.

There are several things to be borne in mind with regard to educational experimentation :

1. Educational experimentation is a new branch and is, therefore, undeveloped and imperfect, and much remains to be learned about it. Its methods of procedure are not so well established as those of chemistry and physics are at present, but these sciences also made a crude beginning.

2. We must recognize our limits, which will, however, broaden from time to time as our knowledge of the subject increases. The solution of many problems is still much beyond us, due to our not being able to control all the conditions that enter. The chemist can now control most of the conditions entering into his experiments, even to very fine differences in weight, quantity, quality, and temperature. By continued effort we shall learn more about the material with which we deal and the laws under which it operates.

3. The patience of an Edison will be needed on the part of the experimenter. If the type of material which Edison handles requires 10,000 attempts\* before success is attained, we can form an idea as to what is before us with at least some experiments. We shall have to improve our method of procedure until our results are constant, or until we can satisfactorily explain why they are not.

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\*See p. 1.

Two precautions should be kept constantly in mind by the experimenter:

1. We must not become so enthusiastic as to lose regard for facts. The chief reason educational experimentation has come into disfavor is that some would-be experimenters have tried something and, with reckless disregard for truth, have claimed certain things as a result. The shallow thinkers have accepted these claims and have spread the news as Gospel truth. The careful thinker finds many flaws in the proof, and, if he forms his opinion of educational experimentation from a case of this kind, he, of course, has no patience with it. Statistics are often very carelessly compiled and are thus also the cause for loss of faith in the method. Some people believe that merely because figures are presented they cannot lie, but statisticians know better.

2. We must not, on the other hand, become so bound to the red tape of an experiment that we thereby shut out the truth. For instance, in the Seminar at the University of Pennsylvania there was a student who was inclined to adhere absolutely to conditions as laid down, merely because they were laid down in the procedure. He did this, regardless of the effect or the value of an individual case; e. g., in a typewriting experiment, when it came to the point where we considered which were the students whose records should be included in the results, we naturally excluded all those who had been absent during the period of the experiment—they did not meet the requirements laid down, one of which was that they had to be present. Then there was brought up for consideration a special case—a boy who had done absolutely nothing, though he had been present all the time. The rest of the class had worked. His record was considerably below that of anybody's else, in fact, so much so that anyone would immediately conclude that his was a special case. The rest of the students showed a uniform record. If he were included in the result, it would reduce the average of the class considerably. It was contended that this boy's record should not be included since he had not done the work properly, but had simply gone through the motions of it. By including him we should get a perverted idea of the effect of the work upon the class. The member of the Seminar in question said, "He was present every time and fulfilled the conditions of the experiment and, therefore, you will have to include him."

The opposite contention was that, when dealing with a small group of pupils, one cannot pronounce such a snap judgment. Though this boy was present each day at the recitation, and though he went through the motions of the recitation, he did not do the work with the same spirit as the rest of the class, and, therefore, should not be included. He was abnormal on

the face of the results and abnormal by the judgment of the teacher who saw him day after day. It would be much more helpful to Education, it would seem, to discard his record entirely, for the other members of the class showed a uniform record. It would be proper, of course, to append a note saying that the results given were for all of the class except one, who did not meet the conditions and then give his record. If one were considering the averages of a thousand children, the result would not be noticeably affected by a case of this kind, but, where one considers the average of a small group, it does figure considerably and should be guarded against.

The term "experiment" as used in this thesis will be taken to include :

The process of testing pupils in order to obtain a norm, as for instance, in the Courtis Arithmetic Tests, so that we can tell what the average attainment is for the children of the country in that subject and can make comparisons.

The process of trying to determine the relative value of two or more methods, or the re-action of various pupils to one method; i. e., varying one factor and keeping all others constant, or compensating for or eliminating any that are not.

We are now ready to proceed to the development of the outline mentioned.

It is felt that this should be done before proceeding with the experiments, because :

1. There are a number of general conditions which hold in most experiments and which, if covered fully here, would avoid much repetition.
2. It would furnish a catalogue of the considerations that arise under each heading in connection with an educational experiment.

Dr. Suhrie's complete headings will be used, as well as the shorter ones of the writer.

## I. FORMULATION OF A PROBLEM FOR EXPERIMENTATION. (Formulation)

### 1. Introduction.

- a. A statement in very general terms of some controverted point or of some unsolved problem in educational method. (General Statement).

It would seem logical to begin by stating, in a very general way, some controverted point or some unsolved problem, on which the contemplated experiment is expected to throw light. The matter would be more easily



understood by everyone if the existing conditions were described in detail, the various methods presented, and the claims stated that are made for each. The flaws or alleged flaws in each of the claims should be pointed out. The experimenter's ideas as to the lines along which the experiment should be made, might also be given here.

For instance, in Typewriting, on the question of Speed and Accuracy, the present situation should be stated; viz., that, so far as is known, there is nothing but opinion to support the methods used. Then the present methods should be given—some teachers place all the emphasis on accuracy, some on speed, and some on a combination of the two. The claims for each method should be stated, and the flaws or defects pointed out by those using some other method should be mentioned. The experimenter, in giving his ideas on the subject, might, in reviewing the situation, ask what is the business man's attitude toward the requirements of the class room. Do his requirements throw out any of the methods under consideration? How can we obtain what he wants?

It might be well for the experimenter to add whether or not, in his opinion, there really is a valid question here, and to give his reasons.

Sometimes it might be well to review at this point, the historical side of the question.

Possibly our first difficulty will be to analyze properly the situation in hand and pick out the elements for which we want to test. A teacher may feel that there is something about a method which is not just as it should be, and yet he cannot make the matter clear enough to anyone else to suggest a remedy. Then again, he may know just what is wrong, or where the trouble lies, but have difficulty in finding a remedy. Or, he may know just what the situation is and be able to explain it, he may know just what must be done, but he may not know of any way of isolating the elements for which he must test in making the experiment. A discussion of these points might find place here.

Under this heading it was intended that the situation should be discussed in the Seminar so as to have the benefit of group judgment in analyzing the conditions and isolating the proper factor which is sought in the test.

- b. A brief survey of the experiments made in the same general field for the scientific determination of the value of factors in educational method and a summary of the results. (Survey of Experiments Made).

Of course, it is only proper that a scientific undertaking should consider efforts that have been made along the same line.

A question that will confront a person making up such a list is whether

or not he should include all attempts or only the valid attempts. One will find that many people, even educators and university department heads, do not understand what is meant by the term "experiment," as was proved by some replies to the letter on p. 6. One may find, if he writes for a list of the experiments in a given field, that there will be included some things that he would not call an experiment, let alone a valid one. It does not seem wise to spend much time in determining what to include and what to exclude. The better policy would call for the inclusion of everything that has even the semblance of an experiment, leaving it to the reader to determine whether or not the thing in question has any use in solving his problem. This policy will keep before us some undertakings which may at some time throw light on other points. Sometimes they at least point the way to the things that should be avoided. It is easier to discard what we do not want, than to seek for something that has been lost.

Bibliographies of some experiments are beginning to appear, which should be consulted.

Information concerning unlisted experiments could be obtained from the various universities conducting experimental work of this kind.

Some of the Research and Test Bureaus of the more progressive educational systems conduct experiments and might be consulted.

It would seem that, in this survey of experiments already made, the following information should be given concerning each:

Name or nature of the experiment  
By whom conducted  
Under what auspices (university, etc.)  
Where made  
When made  
Where the complete report is to be found  
Results briefly stated  
Comments on the results, if deemed advisable.

- c. Differentiation of the problem proposed, from any and all others attempted in the same general field—or a brief statement of reasons for resubmitting the problem to test. (Differentiation—Reasons for Resubmitting).

If the experiment in mind differs from the ones already tried, it would be in order to state the difference. Or, if the experiment is the same, it would seem logical to give some reasons for doing it over again. The reasons may not at once be apparent to the reader and, therefore, should be stated plainly. Sometimes a flaw is later discovered in the method or in the carrying out of the method, and this may necessitate its resubmission.

For instance, it may be discovered later that a serious clerical error, which cannot now be corrected, was made in reporting the results of the experiment; or it may be discovered that a teacher or several teachers did not carry out the instructions properly and feared to hazard their positions, by letting this be known before the report of the experiment was made.

2. Specific statement of the problem so worded as to clearly define the field of the experiment and isolate the factor to be tested. (Specific Statement).

Here should be given a very definite statement of the problem undertaken. This should be very carefully worded so that the exact scope and field of the experiment will be clear.

## II. SELECTION OF LABORATORY FOR EXPERIMENTATION. (Selection of Laboratory)

1. Grade or groups of children selected and a statement of reasons for the particular choice.

Under this heading should be determined what classes or groups of pupils are considered the proper ones as subjects for the experiment. Very few experiments can be tried on all classes. There are usually some reasons why one particular class is the best for the experiment.

Some of the important considerations follow:

The experiment may require that we select:

1. Pupils of a certain class—kindergarten class, 1st to 8th grades, some secondary school class, some post-secondary school class.
2. Pupils taking a certain subject.
3. Pupils of a certain age.
4. Pupils of a certain maturity.
5. Pupils of a certain general intelligence.
6. Pupils having received certain marks.
7. Pupils alphabetically arranged.
8. Pupils having a certain environment.
9. Pupils having equal ability in a subject.
10. Pupils having a certain ability to understand the English language.
11. Pupils having the same teacher.

12. Pupils having a certain teacher.
13. Pupils of the only grade that seems fit for the subject-matter of the experiment.
14. Pupils of one sex.
15. Pupils of the only grade available for experimentation.

1. We may decide to take the pupils in any one or more of our regular classes as we find them in the kindergarten, or in any of the eight grades, or in the junior or the regular high school, or in the normal school, college or university.

2. Or we may want to take special groups within any of these classes, or groups made up of a combination of any of the classes. If we were seeking a norm, as, for instance, in typewriting, we should want the regular classes in typewriting, just as they are organized, which may not coincide with the regular senior class, junior class, etc.

A choice of beginners in a subject, might call forth some pupils from the senior, junior, sophomore, and freshman classes in a high school where the elective system is much in vogue. The same thing would happen if intermediates in a subject were desired, or advanced pupils.

The experiment might require us to rule out those who are repeating the subject, thus breaking up the regular class formation. We might have to rule out those who had previous contact with a subject, as in bookkeeping, because some of the students worked in an office during the summer vacation; or in typewriting, due to some of the students having "picked it up" themselves.

Sometimes the only reason we have for taking a certain grade or class is because the subject under consideration is taught there.

Sometimes it is because the experiment must be made at a certain stage in the subject and the grade chosen is the one in which the work is being done.

3. Pupils of a certain age might be desired, which would take them from the various regular class groups mentioned on p. 31 under 1.

4. Pupils of a certain maturity might be desired, which would have like effect.

5. This would also be true if pupils of a certain general intelligence were wanted.

6. It may be that the previous marks are to be used as a basis, either the marks in general or in a particular subject—the marks for one year, or more, or less; or it may be the marks from one teacher or from a group of teachers.\*

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\*See Equalization tests, p. 50.

7. It may be necessary to divide the pupils of a class into two or more sections alphabetically.

8. It may be necessary to choose pupils having a certain environment, either at home or on the streets, or in school, etc.

9. It may be necessary so to choose the groups that all sections will start on an equal basis, so far as the experiment is concerned.‡

For instance, it would not do to put into one section a larger number of pupils better adapted to the work, than into another section. They might be brighter, more industrious, more energetic, more co-operative, etc. One can readily see, without any argument, that if the A Section contains all of the industrious pupils and the B Section has the laggards, the A Section will by all means show the better results. A test at the end of the given period will not necessarily show the result of the method employed with the A Section as compared with the method employed with the B Section, but will, in all probability, show the result of the application of the pupils of the one group as compared with the lack of application of the pupils of the other group. Even if the methods are reversed (and this is a good way to verify the validity of the results), and the one which was used on the A Section is now used on the B Section, and vice versa, it is altogether likely that the A Section would still show the better results. Right here we have the big flaw in most experiments. How can we tell that both sections are at the same starting point in relation to the experiment in hand? How can we tell that the one section does not have certain advantages over the other at the start, which predestine it to make a better showing, no matter what the method employed is?

Most people will grant that where extreme conditions exist, as in the case given, there is no valid experiment, but some are not so willing to grant that there is a difference worth noting in a group known as "bright" students. Some people would not even grant that there is a difference between those that one teacher considers bright and those that another considers bright. Such a basis for equalizing classes is altogether too unscientific. We cannot simply take a group of pupils whom the teachers consider the bright ones, put half into one section and half into another section and feel content that we have equalized sections.

One often has trouble in determining on what basis the groups should be equalized. For instance, in typewriting one would pronounce an *a priori* judgment that the student who plays the piano has an advantage over those who do not in learning typewriting, because his fingers are supple from the piano practice. Yet, this student may make a poor typist.

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‡See Equalization tests, p. 49ff.

This should be made the subject of a thorough investigation. The records of the West Chester High School show the following:

|                  | No. in<br>Class | No. who play     |       | No. who          |               | Those of very       |              |
|------------------|-----------------|------------------|-------|------------------|---------------|---------------------|--------------|
|                  |                 | No. pass-<br>ing | piano | not pass-<br>ing | play<br>piano | high speed<br>piano | not<br>piano |
| Class A—         |                 |                  |       |                  |               |                     |              |
| Present year ... | 31              | 23               | 9     | 8                | 1             | 3                   | 2            |
| Last year ....   | 25              | 21               | 7     | 4                | 1             | 1                   | 3            |
| Year before ...  | 29              | 29               | 9     | 0                | 0             | 1                   | 1            |
| Class B .....    | 17              | 11               | 3     | 6                | 1             |                     |              |
| Class C .....    | 26              | 23               | 1     | 3                | 2             |                     |              |
| Class D .....    | 29              | 19               | 4     | 10               | 0             |                     |              |

If we have a norm for the subject under consideration, our troubles will be relieved considerably by applying the norm and forming our sections according to it.

In the absence of a norm, we must devise some tests which will equalize our sections. Much difficulty will usually be experienced here. We should give these as pre-preliminary\* tests, to see whether or not they actually give us a method of equalizing. A great deal of effort must be put on these tests. When we have found a valid method, it can be used as an equalization test.

It may be necessary in a typewriting class to equalize the sections on the basis of speed. It may be necessary to equalize the sections of another class according to their ability in any of the elements that make up the subject-matter to be studied; for instance, in typewriting, limberness of fingers; in advanced bookkeeping, a knowledge of debits and credits.

Equalization would not ordinarily be necessary when dealing with thousands, as the large number would absorb individual inequalities. This, of course, could not be true in a small group.

10. In a school containing many foreign-born pupils, it may be necessary to group them according to their ability to understand the English language.

11. The experiment may require two or more sections taught by the same teacher. These conditions will often determine our choice by necessity. The matter of the personality of teachers enters to such an extent, that success or failure of classes often can be traced almost wholly to this factor. "The individuality of the teacher may affect results more strongly than variation in the method that is being investigated."<sup>†</sup> Therefore, it is often best for one teacher to take all sections of a class in an experiment.

\*See p. 48ff.

<sup>†</sup>From Dr. Vocum's "Precautions, etc., needed to the Validity of an Experiment."

12. Sometimes we may choose to take a certain group because their regular teacher is the one best fitted in the school for conducting experiments of this kind, or because the experimenter is the teacher and wishes to observe the work himself.

13. Sometimes we may have to take a certain grade or class because the subject-matter seems best to fit that grade.

14. Occasionally we desire to know whether or not there is any difference in the way a certain method or subject affects the boys and the girls. In that case we would choose on the basis of sex.

15. Not infrequently we must take a certain grade or class because it is the only one available for the experiment. If the conditions seem to indicate that this will not be a serious drawback, it might be advisable to try the experiment, in order to see what results one actually does get under the circumstances. A full statement of conditions should always accompany the results, however, so that no one will be misled and no unwarranted conclusions be spread broadcast.

## 2. Schools Chosen—because of: (Schools Chosen).

In choosing the schools best suited for the experiment in mind, we may select:

1. Schools of a certain grade—elementary, secondary, or higher.
  2. Schools of a certain type—business, normal, or art.
  3. Schools of a certain type—public or private.
  4. Schools having pupils of a certain maturity.
- Schools having certain types of pupils:
5. high, medium, or low.
  6. American or foreign.
  7. white, colored, red, or yellow.
  8. industrious or lazy.
  9. Schools in a certain type of town.
  10. Schools having pupils from certain sections of the community.
  11. Schools to which the experimenter has access.
  12. School or schools in which the experimenter is a teacher.
  13. Schools where the pupils are not antagonistic to experiments, but decidedly co-operative.
  14. Schools where the administrative conditions are good, or better than elsewhere.

15. Schools having the best laboratory facilities.
16. Schools where the teachers are known by the experimenter.
17. Schools nearest at hand.
18. Schools designated by the school authorities.
19. Any school or schools.
20. The only school or schools available.

a. General Character of Student Body—Describe.

1. It may be necessary to choose an elementary, secondary, or higher school—kindergarten, grade school, regular high school, junior or senior high school, junior college or regular college, or university.

2. It may be necessary to choose a school because of the general maturity of its students.

3. It may be necessary to choose a special type of school like a normal school, business school, art school, or trade school, because of the work or type of pupils.

4. One may have to decide between a public and a private school, because of the difference in the character of the student body. It may have to be a choice between the academy and the high school.

5. The School may be chosen because the type of student wanted is high, low, or medium, or because the student body is considered a normal one, or a superior or an inferior one, either by people who know and have grounds for their judgment or by hearsay.

6. A certain school may be chosen because it has a high type of American child or because it has a foreign element.

7. A school may be selected because it is one for white or colored children, for the Red Indian or for the Yellow Oriental children.

8. It may be because the pupils in that school do good work or do poor work; or because they are industrious or are likely to be lazy.

9. It may be because the school is in an industrial, a mining, a milling, or a residential town.

10. It may be because the pupils enrolled come from the industrial section of the town or from the residential section.

b. Accessibility to experimenter.

11. A school may be chosen because the experimenter has access to it.

12. It may be because the experimenter is a teacher or an officer there.

A general condition that applies to all experiments is that the school should be accessible to the experimenter, either personally, through a representative, or through the mails—in other words, that there should



be no obstacles put in the way of his freely communicating with the people who are conducting the experiment.

The only way an experimenter has of knowing that the plans laid down for the experiment are being carried out is by ascertaining how the work is progressing, and being able to get into touch with the people conducting the work, in order to make matters clear.

In some experiments the conditions are so complicated that it would be difficult to explain the whole matter through written instructions, and a personal conference with the teachers is very desirable, if not absolutely necessary.

In other cases, however, where the experiment is purely routine, this is not so necessary, as the instructions can be written and handed to the teachers. Any teacher, sufficiently intelligent to carry on the experiment, ought to be able to read the instructions in such a case and understand them.

Sometimes it is absolutely necessary for the experimenter himself to conduct the experiment, and in such cases, of course, he should have the perfect freedom of the school and be able to reach the school as often as the conduct of the experiment requires. This would apply in cases where a very complicated or highly technical procedure is necessary.

In the case of a personal conference, of course, the school should be accessible to the experimenter in a geographical sense; that is, it should be sufficiently near at hand for him to appear in person; but just as equally important is it that the authorities do not block matters by forbidding him to enter the building. We all know how stubborn some school authorities have become, and the report of an experiment should contain a definite statement that the school was or was not accessible according to these various meanings.

In the case where written instructions are all that are necessary, the school should be accessible to the experimenter in the sense that when he sends the written instructions through the mail or otherwise, the principal, or the person to whom he addresses them, will see that they are delivered to the proper teachers in due time.

If the experimenter lived in San Francisco, and it was a very complicated experiment that required several conferences, and the experiment was to be conducted in Philadelphia, it would be plainly evident that he could not come to Philadelphia very often, which fact may bring about invalid results through misunderstandings. If he does come to Philadelphia as often as is necessary to make matters clear, that fact should be definitely stated (saying just how often the visits were made), so that complete

information is at hand in case matters do not work out properly and the cause therefore is sought.

In some experiments it will be necessary for the experimenter to hold several conferences with the teachers who are conducting the experiment. Of course, conditions will have to be such that this can be done. If a very complicated procedure or a very indefinite procedure is mapped out, and the teachers cannot keep in touch with the experimenter to have disputed points cleared up, it is very doubtful that the experiment is going to be carried out so as to insure valid results. All the necessary conferences should be held with the persons concerned and a statement to that effect should be made in reporting the experiment so that the matter will not be left in doubt. One slip in any of the conditions may make the results invalid. If they are invalid, we want to know it, so that we can tell whether our method of procedure is wrong or whether the trouble lies in the conduct of the experiment.

The experimenter may train a corps of workers and send them out over the country to conduct the experiment, when complicated procedure is involved and one person cannot do it all.

In some experiments the experimenter will have to be present in order to be certain that the instructions are being carried out just as he intended. This is necessary in very complicated ones, and in those in which unexpected re-actions are likely to take place where a quick decision as to the course of procedure will have to be made. Naturally only he, because he knows most about the experiment, will be able to render a wise judgment.

In the experiments recorded, where the conditions just enumerated hold, a mere statement that the school should be accessible to the experimenter will be made, together with a reference to this section.

c. Co-operation of All Concerned—Reasons for Assuming This. (Co-operation).

It may be necessary to find schools where the pupils are not antagonistic to experimentation, but decidedly co-operative.

14. It may be that schools are required where the administrative conditions are good, or better than elsewhere.

One essential in every experiment is that there should be the necessary co-operation on the part of the class, the teacher, the principal, the supervisory officers, the superintendent, and the investigator or experimenter—in short, on the part of everybody concerned in the experiment.

A long explanation as to the necessity of this is hardly called for. One can readily see that, no matter how carefully an experiment is planned, valid results can hardly be expected, if the teacher refuses to carry it out

properly, or shows by her attitude that she does not care whether the work is done properly or not. Or the class may become antagonistic and will carry out the instructions only formally, if even that much; or may, just for sheer contrariness, put down the wrong answers, as is often done in questionnaires; or the principal, or superintendent, or supervisory officers may interfere and raise objections to one part of the experiment and may not permit another part of it to be carried out, or may create an unfavorable atmosphere in the class room, etc.

Neither is it worth while to experiment in a school where the powers that be, or the teachers, are opposed to experimental methods. We all know of types of principals, superintendents, supervisors, and teachers, who are very much opposed to anything called progressive—anything different from what they have been accustomed to for years. It is not worth while in those schools whose teachers, either through failure, or exceptional success without knowing why they have had success, conclude that teaching is simply a complicated problem, which can never be disentangled, and that these experiments are useless; or in those whose teachers are so material that, while they can readily see how a person can analyze a chemical compound, they cannot see how the psychical elements can be isolated for experimentation. Where persons absolutely oppose this type of investigation, it is questionable whether the experiment will be conducted properly or not.

Co-operation on the part of the students\* is also absolutely necessary. Otherwise the results will be invalid. The freshman of the West Chester High School were given the Otis intelligence test in 1919 under conditions which made the students decidedly antagonistic and affected the results. The class was divided into two sections. Much time was lost in conducting the test with the first section, which made the second section late in starting the test. Before completing it, the dismissal bell rang. The students became very uneasy but were required to finish the work. On questioning some of them the next day they said they did not care what they put down, they "wanted to get out." The results of that test cannot be counted as valid. They cannot show a true state of affairs with regard to the freshmen of that high school, and yet the experimenter intended to use them as such at one of our Eastern universities, despite all protests to the contrary.

Numerous other examples could be given, but it is believed that the reader sees the absolute necessity for co-operation, without going into the matter further.

If it should happen that, in the conduct of an experiment, any lack of

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\*See p. 54.

co-operation becomes evident, an explicit note, stating just what form it takes and to what extent it has interfered with the experiment, should be made, so that the matter may be borne in mind when the results are considered.

Reasons for assuming that this co-operation exists should be given; e. g., the spoken or written promises to that effect, attitude and actions in preliminary meetings and throughout the test, professional interest of the persons involved, such as taking university courses in the subject, progressive attitude along educational lines, attitude in previous similar experiments, etc. These persons may be conducting experiments themselves. It may be that they are in the department of the school system which regularly does this work.

Nothing should be left in doubt. It is better to err by inserting too much detail in the report than not enough. What now appears to be useless detail in a report of this kind, may some day help to solve a question raised.

As this applies to all experiments, the mere fact that co-operation is necessary will be stated in the experiments that follow, and a reference will be made to this section for further detail, in order to save unnecessary bulk in printing.

d. Any Other Reasons.

15. A school may be chosen because it has the proper laboratory facilities.

16. It may be because the experimenter knows the teachers at that school, and can vouch for their attitude toward the matter in hand.

17. A school may be chosen because of the proximity of its location, making it possible for the experimenter to have personal conferences with the teachers who are to conduct the work.

18. A certain school may be chosen because there is an understanding with the school authorities to use that school, or there may be permission from headquarters to do so, implying that other schools may not be used. It may be that the school board has given permission to have the experiment tried there.

It may be difficult to find a school or schools where the experiment can be given, because the school authorities object to experimenting on general grounds.

Or it may be that the objection is raised because there is too much at stake. If the plan does not seem very plausible, it may happen that one section of the class advances faster than the other and then there is that deficiency to be made up, because of which the authorities would not want to have it tried on any great number of students. Or it may be that seniors in high school are the students to take the work. Each senior

must reach a certain standard in order to graduate. Even a short period required for an experiment might throw one or both sections so far behind that it is only with the greatest difficulty that the work could be made up before graduation.

The time required for an experiment may be over too long a period, and the authorities may feel that they cannot very well consent to the loss of that time by experimentation.

While they might grant that it would be a gain to the students as a whole, it might be a loss to certain students, and they might not feel justified in attempting it because of this.

19. Any school or schools may be chosen as in the case of standardized tests, where it is the object to obtain the status of things under conditions as they exist.

20. A school may be chosen because it is the only one available, either for the purpose, or to the experimenter.

3. Teachers in Charge of Grades or Groups. Selected because:  
(Teachers Chosen).

A teacher may be chosen because:

- a. 1. Of her intelligence.
2. Of her co-operation.
- b. 3. Of her scientific attitude of mind.
- c. 4. Of her professional attitude.
5. The students have confidence in her ability.
- d. 6. The group has been chosen by H-1 and the regular teacher must take charge of the group.
7. She has sufficient resourcefulness to handle two sections using different methods.
8. She has foresight enough to notice varying conditions.
9. Because the students are familiar with her and if someone else were to conduct the work, there would be a disturbing element introduced which might affect the results.
- a. Intelligent with reference to controlling conditions of test, in co-operation with experimenter or investigator. Precautions taken to insure this.

1. If a teacher is to conduct the experiment, she\* should be the best

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\*She—generic.

teacher available for the purpose. She should be sufficiently intelligent to understand the experiment thoroughly, and capable of mastering all the details. She should be thoroughly capable of breaking away from her trodden path and carrying out the lesson in accordance with a new idea. She should not be "set in her ways."

She should be one who can thoroughly grasp the importance of the experiment and the idea contained in it.

2. She ought to be capable of co-operating with the experimenter and willing to co-operate, by actions as well as by words.

The necessity for co-operation is given on p. 38 ff.

b. Scientific attitude of mind.—Reasons for believing this.

3. She should be a teacher with the scientific attitude; that is, she should be one who takes the stand that, while we do not know everything in Education at present, we shall know a great deal more if we keep studying the subject. She must be one who believes that, out of the tangle of conditions found in the class room, we ought to be able to pick the separate threads and by diligent, careful experimenting, to be able to get some light on the subject. She should be open-minded and not prejudiced in any way, and should be willing to throw overboard her pet theories if they are wrong, and she ought not to be unwilling to test them out fairly.

It may be that she has taken work at a university along this line or is a member of a seminar, committee, or commission that does work of this kind, and has successfully conducted other experiments.

She may have shown her scientific attitude by previous work done or by interest shown in this work through actions, words, or deeds.

Reasons for believing that the teacher meets these requirements should be given in the report.

c. Professionally interested in results of test.

4. She should be a teacher who takes pride in her profession and is willing to advance it wherever she can. She should be progressive, being on the watch for new methods and for the latest findings in Education, and therefore interested in what can be learned for the profession through an experiment of the kind in mind. She ought to be interested in trying to get the body of knowledge in Education so well organized that all fair-thinking people will grant that Education is a science.

Her professional interest could be ascertained by her general attitude in school work—being interested in obtaining the best possible results in her room and her work and, therefore, being willing to try to find the best possible method of doing it.

Reasons for believing the teacher to be of this kind, should be given in the report.

4. She should be a good disciplinarian, so that the most favorable conditions for attention will prevail in her room. She should be a teacher with whom the pupils co-operate and one who does not antagonize them. She should not be of the type that has the pupils so frightened that they lose their thinking powers and become nervous and upset while being tested. A kindly-disposed, helpful teacher, whom the pupils love and not fear, and with whom they are intimate, would be the best. Thus she can get the fullest co-operation of the children.

5. She must be a teacher who has a sufficient reputation among the students for knowing what she is doing, so that, if the experiment requires their working in the dark for a time, their confidence in her saying that everything will come out all right, will keep them diligently at work on it.

d. Any other reasons.

6. She may be selected because the group has been chosen by any of the reasons under II-1, p. 31, and she is the regular teacher who must take charge of the group.

7. She must have sufficient resourcefulness to be able to handle two or more sections, each using a different method.

8. She should be a keen observer and be able to detect any varying conditions that might have weight in the test, and be able to size them up at the time. She should have foresight enough to recognize any unlooked-for re-actions or turns of events which might prove important when considering the results. These incidents should be written out in full detail at the time and the memorandum handed to the experimenter.

9. Sometimes an experiment will not permit a strange person coming in and taking charge of the class. If a class is accustomed to a certain teacher, it does not always readily adjust itself to the ways, mannerisms, voice, and requirements of a new person. Of course, this would have considerable effect on some experiments, and for that reason the regular teacher is sometimes needed.

10. It may be necessary to choose a certain teacher because no other is available. When we must resort to anything of this kind, it should always be stated when giving out results.

Reasons for believing the teacher to fulfill the requirements should be given in the report.

Of course, in much of the foregoing, ideal requirements have been given. It will not always be possible to obtain just the type of teacher

wanted. The proper type of pupils will often be available but no teacher of the kind required. It may happen that the teacher will not affect the pupils as would be expected, and that valid results will be obtained nevertheless. But it may also happen that she proves to be a considerably disturbing element and consequently throws results far off. If information concerning her is at hand, an allowance can be made accordingly when considering the results.

### III. CHOICE OF CONDUCTOR OF EXPERIMENT. (Choice of Conductor)

By "conductor of the experiment" is meant the person who is actually doing the work of carrying on the experiment with the pupils. For this purpose any one or more of the following persons could be used: the investigator or experimenter, one of the teachers, the school principal, the school superintendent, or anyone else who has the necessary qualifications.

In planning an experiment, each of these should be considered as a possibility, and the reasons for and against should be jotted down so they can be incorporated in the final report, so that, if a question arises on the matter of choice of conductor, the reasons for making the choice outlined will be available.

One thing that must be borne in mind is that when these terms are used, the person himself is not thought of, but the position with respect to the experiment that the person holds. For instance, the experimenter may also be the teacher of the class, or the principal may be the experimenter, or the superintendent may be the experimenter, etc. What is said about the teacher in charge of the experiment applies to the person acting in that capacity, whether it be the investigator, principal, superintendent, or anyone else. When we speak of the principal, we mean the person as such, and in that capacity only.

- I. A consideration of each of the following agents or any combination of them collaborating as best adapted to the purpose of the experiment and most likely to secure valid results.

- a. The Investigator—why or why not?

The investigator or experimenter may be chosen because he is or he is not the teacher of the class, for the same reasons as given under II-3, p. 41, for Teacher in Charge.

In this thesis the words "investigator" and "experimenter" will be used



synonymously. Generally speaking, the investigator is not the best person to conduct the experiment. The regular teacher answers the purpose better, as stated under the next heading. There are, however, some experiments so complicated, or requiring so much technical knowledge with which the investigator alone is familiar, that it becomes necessary for him to conduct the experiment. If this happens to be the case, full details of the situation should be given in the report. Of course, if the experimenter happens to be the teacher of the class on whom the experiment is to be tried, that alters the situation.

b. Teacher in charge of the grade or group—why or why not?

The teacher in charge of the grade or group may be chosen for any of the reasons given under 11-3, p. 41.

Generally speaking, the teacher in charge of the class is the most suitable person for conducting the experiment. She should be chosen in certain cases because the students are familiar with her and therefore there will be no disturbing element as there would be by bringing into the group a strange person to conduct the experiment.

In the case of an experiment that starts with the beginning of a year or term, before the pupils have become acquainted with the teacher, it does not matter so much, and someone else could conduct it just as well, but many experiments involve teaching or drilling somewhere in the middle or at the end of the term and this can only be done well by the teacher who had the class right along, or at some previous time. To bring in another person would mean that some time would be lost by the pupils in becoming familiar with the person and in becoming accustomed to her ways—method, discipline, voice, requirements, manners, standards, etc.

Someone else could also conduct an experiment where there is no teaching to be done—where it is merely a matter of finding the present status of affairs, as, for instance, ascertaining the present speed of pupils in typewriting; but even then, the mere presence of a stranger in the room and the consciousness on the part of the pupils that a stranger is timing them instead of their regular teacher, may prove a disturbing element and make considerable difference with certain types of "nervous" pupils, and if there were any of that type in the class, it would not be well to let the experimenter do even this simple act, when he is not the regular teacher.

c. The principal in charge of a building—why or why not?

The traditional principal is not a good person to conduct the experiment, because the pupils fear him and that introduces an unnatural ele-

ment into the matter, and we can hardly expect the best results. Usually the principal is not in the good graces of the students and will not be able to get their co-operation. If he is not of the traditional type, or if he is the regular teacher of the class, that alters the case.

The same reasons given under II-3, p. 41, would apply here also.

d. The superintendent in charge of a system—why or why not?

The traditional superintendent is feared possibly even more than the principal, and it would not be wise, under these circumstances, to have him conduct the experiment, if that factor is likely to enter into the results. If he can go into the class room, however, without causing any changed attitude on the part of the students, it would be a different matter.

The reasons given under II-3, p. 41, would also apply.

e. Anyone else.

The reasons given for experimenter, teacher, principal, and superintendent would apply to anyone else in charge of the experiment.

2. Agent\* (or Agents) Selected as Determined by: (Agent Selected).

a. Ideal desirability.

Of course, in many experiments, it is desirable to have ideal conditions in every respect, and this would include choosing the ideal person to conduct the experiment.

b. Expediency.

But this is often impossible and then it becomes necessary to take the next best, that is, the expedient, as it is worded in the outline; not that thereby just as good results are obtained as would be the case if ideal conditions prevailed, but simply that it is thought better to deal with what is available and find out what those conditions will reveal, than not to try at all. Trying out the experiment under conditions that even fall short of the ideal will shed some light on the problem at least, which will no doubt be helpful and may point the way out of some difficulty. Of course, before an elaborate experiment is tried on a large scale, it is well to consider whether the conditions obtainable approach the ideal sufficiently to war-

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\*By "agent" is meant the conductor of the experiment.

rant the expenditure of so much money. Meanwhile, efforts would better be confined to experiments on a small scale, with the object of learning as much as possible about them before investing in them a very large sum of money, time, and effort.

Whenever it is not possible to obtain just what is wanted, the grounds upon which the choice was made should be stated.

c. Necessity.

When ideal conditions are unobtainable and no choice in the matter is given, it sometimes becomes necessary to take what circumstances thrust upon one. This applies in general, as well as to the matter of choosing the agent for conducting the experiment. On the whole, it is better to conduct the experiment even under such conditions (though not for publication), for some illuminating side-lights, which may be of considerable help in various ways, may be brought forth.

The conditions which forced such a course should always be stated.

#### IV. DEVELOPMENT OF A PROCEDURE FOR EXPERIMENT. (Development of Procedure)

1. Content—should include a full consideration of:  
General plan in brief.

In some experiments the development of the procedure will be better understood by the reader, if the genral plan is briefly given at this point. This is especially the case when the method is very complicated. Therefore it has been thought well to include it in some of the experiments covered by this thesis.

- a. Difficulties encountered and plans for overcoming them. (Difficulties).

(1). Tests.

Some definitions are necessary at this point.

**FINAL TEST.** By this term we shall mean a test which is given to the pupils at the end of the time allotted for an experiment, the results of which test will be used in determining the progress made by each group during the experiment. Each experiment will have a final test of some kind.

**EQUALIZATION TEST.** By this term we shall mean a test given be-

fore the experiment begins, given for the purpose of equalizing the sections or groups of a class so that one group will not be handicapped in the experiment because of not having the same chance at the start. For instance, in a typewriting experiment which involved speed work, we would not want one section to have a higher speed than the other at the start. One section would have an advantage over the other. The test we would give to the students to equalize the speed of the sections would be an equalization test.

Sometimes one test will answer the purposes of the equalization test and the preliminary test. This is the case in some typewriting experiments.

**PRELIMINARY TEST.** By this term we shall mean the test given at the beginning of an experiment for the purpose of obtaining data which will be compared with those of the final test. The difference between the results of the two tests will show the gain that has been made during the time of the experiment.

**PRE-PRELIMINARY TEST.** By this term we shall mean any tests which are not a part of the experiment itself, but which are given for the purpose of clearing up any situation in connection with a contemplated experiment.

It seems necessary in our terms to distinguish between such a test and the one described under the term "Preliminary Test." Dr. Suhrie does not use the term "pre-preliminary" but uses "preliminary" in the sense here used for "pre-preliminary." A word had to be found for another class of tests and in the Seminar the word "pre-preliminary" was used, although half in jest. It may not be elegant but inasmuch as it clearly expresses the idea of tests taken even before the preliminary test can be taken, and inasmuch as a number of students in educational research are familiar with the term, its use is felt justified.

A consideration of the tests will now be undertaken.

**PRE-PRELIMINARY TESTS** should be used in every experiment where we are not absolutely sure of our grounds. They should be used to determine whether or not the idea in mind is practicable. There are so many factors entering into an educational experiment that no one can be certain that a plan he has in mind will actually work out until it has been tried. Pre-preliminary tests are to be used in determining this.

Even after an experimenter has a workable procedure he should try out the whole experiment in a small way before going to the expense of undertaking one on a large scale. Sometimes the actual working out of an experiment in this pre-preliminary way brings us revelations which are quite surprising.

Pre-preliminary tests may be used to ascertain the "unknown" in con-

nection with any experiment. There are likely to be several factors which escaped the experimenter, even after careful thought. A pre-preliminary test may bring some of them to light.

There may be a number of disturbing factors connected with an experiment, that a pre-preliminary test may help to discover. A number of situations may prove quite annoying to the students, which we do not feel would be noticeable.

It may be very difficult to select subject-matter for the actual experiment or for the equalization, preliminary, or final tests. The easiest way out of the difficulty is to prepare what is thought to be a suitable test for equalization, for the preliminary, or the final test, and give it to the students. Likewise it is possible to try out on the students in this pre-preliminary way, the kind of drills that are contemplated for the experiment itself.

The time element may require some testing. It may be difficult to tell how long an equalization, a preliminary, or a final test to give. A pre-preliminary test should be given for the purpose of determining this. If one test is found too long, another should be tried. If that is found too short, a medium one could be tried, etc.

It may be a question of the length of the instruction period, or drill period. The experimenter should decide upon a period he thinks proper and then try it out, making it longer or shorter, as may be necessary. In the case of not knowing the length of time to devote to an experiment, it will simply mean making several pre-preliminary experiments until that element is properly adjusted.

It may not be known whether the work can be done properly in the room assigned for it. The only way to be absolutely certain is to try it out by giving a pre-preliminary test in that room.

Any other questions that arise in connection with a contemplated experiment should be tried out with pre-preliminary tests, given under the same conditions as will obtain in the experiment itself. For example, we may wish to know whether any students would be disturbed by a person walking around the room during a typewriting test; or whether there is much difference in the personal co-efficients of a class. We may want to know how much time it takes to do a certain thing. A pre-preliminary test would help to decide these questions.

**EQUALIZATION TEST.** The need for equalization has already been mentioned on p. 33 ff.

To devise the proper equalization test may give us more trouble than anything else in the experiment. It can readily be seen that if the two sections of a class are not equalized in some way, the results cannot be

counted valid because some of the students may have had a considerable handicap in any number of respects. For instance, in experimenting with a class in Rapid Addition, where two parallel sections are needed, it would be decidedly unfair to put all the rapid adders and the accurate adders into one section and the others into another section. The only way we can be sure we are not doing this is to give an equalization test.

It is going to require a number of years before we can find satisfactory equalization tests for some subjects. It is not merely a question of carefully thinking out a test, but the test itself must be tried out on a large scale, and the results must show that it really does what it was intended to do. Then also, the results of the test must be verified, which often takes a considerable time. For example, to obtain a test of the typewriting ability of students about to take up the work, which test could be used to equalize the sections of a beginners' class on which we wish to experiment, it would be necessary, in the first place, to decide what factors we believe constitute typewriting ability, and to give the tests to a large number of students. Then we would have to wait a year or so, to see whether the progress made by those students is in accordance with the prediction of the test. At the end of another year or so, the comparison should again be made for the same purpose. If we find uniform agreement, we can feel that we have found a test such as we are seeking.

Of course, the question is raised as to what we shall do in the meanwhile with typewriting experiments that require this test. We may proceed with them as best we can, for three reasons:

1. The differences in typewriting ability may not be so great as we think, and this factor may be a very minor one in the experiment, which the results are likely to show.
2. If large numbers are involved, these individual differences would be absorbed.
3. Testing out the rest of the procedure may be a justification. The correctness of this portion will be established or disproved.

It is not a very satisfactory method to equalize sections on the basis of the marks or grades which the students have made, represented by the judgment marks of the teachers, although if the marks for the entire group are given by the same teacher or teachers and cover a considerable period of time, they are less apt to be worthless for our purpose, than if they were given by different teachers or for only a short length of time.

PRELIMINARY TEST. As a rule we shall need two sets of data, which will be made the basis of calculating the results of the experiment.

We shall want one set at the beginning and one set at the completion of the experiment. These will be compared and will show the progress made during the experiment. The data will usually be obtained by giving some kind of a test. The one at the beginning of the experiment we shall call the "Preliminary Test," and the one at the end we shall call the "Final Test."

Frequently the equalization test can also be used as a preliminary test.  
FINAL TESTS. Note what has been said under "Preliminary Test."

(2) Preliminary conferences with school officials and teachers.

An experimenter may have considerable difficulty in obtaining satisfactory conferences with school officials and teachers, preliminary to the experiment.

Of course, there are some experiments where the procedure is so simple that it could be written out and sent to the teachers, but there are others so complicated that it would be necessary to instruct the teacher in person. If the school officials and the teachers will not co-operate to the extent of having the necessary conferences with the experimenter, the project might just as well be abandoned in that school, because, without the necessary co-operation, the results obtained could not be counted as valid.

(3) Other difficulties.

There may be a number of other difficulties, which may be encountered, viz.:

### SCORING

Let us grant that we have found the proper tests. Our real troubles have not vanished. How shall the papers be marked? Shall we consider answers as being either right or wrong, or shall we give credit for fractional parts of the answers which are correct? One way out of this difficulty is to bear the fact in mind, when making up the questions, and arrange them so that the answers will be either right or wrong. Give no place for middle ground.

In bookkeeping, let us say, we have given the student some transactions, for which entries are to be made; he is also to post and take a trial balance. Are we going to count the whole matter wrong because he cannot get his trial balance? He may have everything correct but the addition of one small column, which throws out his trial balance. Are we going to

count it entirely wrong or give him some credit? If some credit is given, then how much? Suppose in a journal entry he has the debit correct and the credit wrong, shall we count the whole transaction wrong, or say it is half correct? Suppose he has the debit correct and also the credit, but he has put down the wrong figure, say, for the debit. Shall we count it all wrong, half wrong, one quarter wrong, or what?

In typewriting, for instance, before 1918 only 5 points were deducted for an error, while the next year the penalty was increased to 10 points for each error. Which should we use?

Where questions require answers that run into any number of words, or where the answer involves several ideas, it is sometimes difficult to know how to mark the answer. Shall we give the student credit for knowing the answer, even if he does not state it clearly, when we know it is clear in his mind, possibly from a conversation with him right before class? We are trying to find what is in his mind, and, if we really know, that is the data we should use, and not the data that is on paper and incorrectly placed there. Placing things on paper is simply a means that we have adopted to ascertain what is in the mind. The method we are using may be wrong. We are seeking what the student knows. On the other hand, if we follow a certain plan with one pupil, it would be unfair to others, who may be in the same position.

To what extent will English enter into the question? Are we going to mark for neatness of papers, or only for the subject-matter? In bookkeeping, are we going to penalize the bookkeeping mark for the poor penmanship, which is responsible for the untidy appearance of the books? Are we going to deduct from his mark, supposed to show his bookkeeping knowledge, any lack of preparation in fundamentals, as in addition, etc.? To be sure these are necessary to make a good bookkeeper, but possibly it is his understanding of bookkeeping that we are trying to measure, and that would primarily mean the system of debits and credits, and not ability in addition or subtraction.

Possibly the best way out of difficult marking is to analyze the situation and see what elements should be included in the answer to the question. For instance, take the question: "Tell what the Negotiable Instruments Law is." In answer to this question, the student should include the following ideas: It is a law, drawn up in the U. S. A., by the American Bar Association, within the last few decades, with the idea of making it possible for all our states to have uniform laws regarding negotiable instruments. There are five ideas. If the student has given all of the five, we shall count his answer correct. If any one is missing, we shall deduct one fifth.



Our scheme is spoiled, however, when the student has correctly answered all of the question and then adds something that is not right. Are we going to give him full value for this question? If not, how much are we going to deduct?

To be specific, take the commercial law question just stated; suppose some student gives much more information than that above (and all of it is correct), are we going to give him the same mark as the person who has given only the five ideas enumerated? It does not seem fair, and yet, we made it plain to the class that we require only the chief ideas, and others, proceeding on this assumption have given us the five. Should they get any less than a correct mark for the question?

Another question that arises is this: By whom are the papers to be marked? May the pupils do it or must the teacher or some clerical force do it? In some things, where there is little possibility of cheating, the pupils may be trusted to do it, but in other cases this cannot be done.

The book, "Commercial Tests and How to Give Them,"\* suggests having the paper marked by the person who has written it, after it has been checked by another pupil whose name is affixed, and re-checked by still another pupil whose name is also affixed. This gives a very close check on the marking, and saves a great deal of work on the part of the teacher.

### PROCEDURE WITH KNOWLEDGE OR WITHOUT

A question that is sometimes hard to decide is this: Should the pupils do the experiment with a full knowledge of the reasons for it, etc., or should they not? Should they even know that an experiment is going on—that it is not regular class work that is being done?

The arguments are:

That we can hardly expect the student to give us what we want, if he does not know fully what is expected. For example, if we tell the pupils that a test is being made, the results of which are going to the university, or are to be compared with other schools of the state or country, we immediately prompt some students to do their best, but others are made so nervous that they cannot do well. If the pupils do not know just what we want, the most resourceful one might, out of his originality, do just what we want, had he known it. If a student does not know that he is to hurry, he will take his time. He might be able to do more than he does, and would do it, if he knows speed is desired. No boy is on his toes all the time and we may be marking him unfairly.

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\*By Sherwin Cody, published by World Book Co., Yonkers, N. Y.

Some students are prompted to be "smart" as soon as they know something of this nature is going on. An illustration is the tests of Bible knowledge given college students. They knew someone was trying to ascertain how stupid they were on matters of this kind, and they did not want to disappoint him.

If the students know it is an experiment, those antagonistic to such things will immediately withhold their co-operation.

If two methods are being tried out and one of these methods is distasteful to the students (irrespective as to whether or not it produces the better results), and if they suspect that the policy after the experiment will be determined by the results of the experiment, they are likely to put their heads together and defeat the method that is distasteful to them.

It is indeed difficult to know just how much to tell the students.

#### ANTAGONISTIC ATTITUDE OF PUPIL AND REFUSAL TO CO-OPERATE

Trouble may be caused by a considerable number of pupils, or even a few, taking an antagonistic attitude towards the experiment and some of them absolutely refusing to co-operate. One case in mind is that of a girl who did not see any sense in experiments. She was not getting along any too well with her regular work and this afforded her more ground to find fault. It would seem that the only proper course, in a case of this kind, would be to exclude her results when figuring the results of a small group. If a large group were being averaged, her peculiarities would be lost in the average, but they would not be in the average of a small group. The one reporting an experiment should not absolutely ignore her, but should state the conditions and the results obtained by her. If later a question should arise about the wisdom of excluding her in the average, she may still be included without any trouble, if judgment pronounces it wiser.

#### INABILITY OF PUPILS TO DO WORK

Another case comes to mind which should not be counted in a small experiment when averaging results. This was also in a typewriting experiment. The girl in question came to school each day in such condition that she was not really able to do the work as it should be done. She was a society butterfly, being out late to dances nearly every night during the week, coming to school at the last stroke of nine and being half asleep when she got there. It was plainly seen that she could not do efficient

work and for that reason was not meeting the requirements of the experiment and should not be included when averaging the results.

In a small group, an experimenter is often concerned for fear there may not be many whose results may be figured in the average, because a number of the students have made themselves ineligible by reason of absence, inability or indisposition to do the work.

- b. Dates and days on which instruction, drills or tests are to be given. (Time).

In considering the time for an experiment, there are several things which should not be omitted:

The dates of the beginning and ending of the experiment should be set definitely, if the nature of the experiment allows it. That involves the length of the period during which the experiment is to take place. We must look ahead and see that our time calculation is not affected by holidays (both regular and special) and by vacations. If one is not careful, he finds, after having nearly completed an experiment, that a holiday or vacation interferes and upsets everything. This would be very serious in an experiment where the time element must be carefully considered. Gentiles must bear in mind the fact that if the group to take the experiment contains a considerable number of children of the Jewish faith, the Jewish holidays must also be taken into consideration.

As far as can be the case, we should also consider possible epidemics in this connection. For instance, when the Spanish Influenza was sweeping nearby districts, it would have been unwise to have started an experiment, because the likelihood was very great that any schools in question would be closed, or else there would be so many absent that the effort of the experiment would be practically useless.

If normal conditions are essential, it is unwise to begin an experiment when war time excitement prevails as has just been the case in our land. It is too much of a disturbing element both for the teacher and the pupil.

If it is known that for any reason many pupils are likely to be absent, the experiment should be postponed until another time. It means that in the results under such conditions only a small number of students could be taken into the account. We all know that it is more desirable to have the largest possible number of students eligible for the results. It helps to eliminate the individual element and gives us an average from a greater number.

In considering the end of the experiment, we must bear in mind that while we must make the experiment long enough to really show results, yet there are cases where it would defeat its object, if the time were too

long. If the same subject-matter is used and a long period of time is given, both sections are likely to master the subject-matter because of the mere drill they have had on it, regardless of the method used.

Or if the time is too long, the students may become disinterested and the conditions of the experiment would not be met. The time must not be long enough to be tiring, especially if the method is not very self-recommending.

On the other hand, it cannot be so short that neither method has had an opportunity to work.

We must be particular in choosing the day for the final test. It should not come immediately after a week-end, holiday, or vacation. In some experiments this would be a considerable item. In typewriting, for instance, speed tests would show better results if given at the end of the week, than immediately after a vacation, or even a few days' rest.

The days of the week on which the experiment is to be conducted must also be determined. This will involve the interval of repetition. In experiments requiring every-other-day meetings of the groups, we face the uncompromising odd day in the week. We could hardly keep perfect every-other-day intervals, for no one would want to come to school on Sundays or Saturdays when necessary. Yet this obstacle is not so important as it looks at first sight, because even if we did ascertain what could be done under a perfect every-other-day schedule, it would be of very little practical value to us because we do not and could not run our schools that way. It would be more practical to ascertain what could be done with Monday-Wednesday-Friday classes. If the interval is the important factor, holidays must be watched or they will upset our plans.

Another vexatious question is, how are we to decide what the proper intervals are or should be. Pre-preliminary tests might help to answer this.

- c. Time of day when presentations, drills and tests are to be given. (Periods).

This consideration is likely to give us some trouble when trying to work out experiments. In the first place, we have to decide what periods or hours of the day are most suitable for the experiment under consideration, and, in the second place, we shall have a try to have the school schedule arranged to suit.

In determining the most desirable period of the day we must bear several things in mind, which may affect the proposed experiment. We must avoid periods when the students are fatigued because of the work done in the periods immediately preceding. It should not be the end of a heavy session, either morning or afternoon.

It should not be immediately after any classes that require an undue amount of concentration, which will leave its effect on the minds of the students through fatigue. A combination of Algebra, Latin, and Trigonometry classes, immediately before the experiment period, would be unfortunate.

We must avoid periods following those wherein the students have had a hilarious time and because of that fact cannot immediately settle down to work.

We must consider what the students' preceding activities are, as well as his inactivities. Sometimes the inactivities are more disastrous to the experiment than the activities.

The period which follows may be a factor. The anticipation of it may be a disturbance.

We must avoid all periods that follow any wherein the students have been made unfit, through any cause, for the immediate application of their minds to the work in hand.

We must avoid also the periods when the teacher for any reason is not in shape to be most efficient.

In the case of typewriting, during the winter months, the first period of a session would not be the most desirable, because for some of the late-comers, the fingers might still be so cold that they could not do efficient work in manipulating them. If no other period is available, it may be necessary to postpone the experiment until another season of the year.

If a particular laboratory is necessary, as, for instance, in typewriting, we must be certain that the periods decided upon are those when the room is at our disposal.

It will not always be possible to arrange a school schedule to fit the ideal desirability of an experiment, and then it would mean either conducting the experiment during the periods that are available or not conducting it at all. It would be a question of choosing the lesser of the two evils. Ordinarily it would seem best to try the experiment even under the adverse conditions, unless they were extremely so. Of course, the results ought not to be given out without clearly stating that the desired conditions did not prevail and that therefore the results are not absolutely reliable.

Our report of the experiment should always state what precedes the period, for the session at least. It would do no harm to give the complete schedule of the students for the whole day up to that period.

- d. Subject-matter to be used as basis of instruction, drill or tests.  
(Subject-matter).

The subject-matter of the instruction, drills, or tests, will have to be determined next. Of course, that can be determined only after we clearly know for what we are testing or experimenting. If any questions arise as to practicability, we might save time by using pre-preliminary tests as mentioned on p. 48 ff.

We should be very definite in our report. We should give all the details of the study, so that any one reading the outline, even if he did not know the subject taught, would be able to appreciate the points and contentions held.

The drills and tests should be given in detail, as well as an example, at least, of the lessons under each method.

We should state the subject in which the experiment is being given, the sections of the subject to be covered, name of text (if one is to be used), and pages or paragraphs to be covered, also name of publisher. This will make for definiteness, and be valuable for future reference.

c. Details of Procedure proposed for experimenter or his assistants in conducting the experiment. For example:

(1) Copies of instruction to be given to helpers with statement of precautions to be observed.

We now come to a consideration of all other details of procedure that have not been covered.

We must work out the instructions which are to be given to the helpers, and the precautions that must be observed. These should be handed to the assistants in written form, regardless of any personal conferences. It is so easy to forget unless instructions are in definite, written form.

(2) Time limits fixed for periods of instruction, drill or test —with precautions to be observed.

We should consider the precautions necessary so far as observing the time limits in the drills, instructions, and tests, is concerned.

(3) Form, order and method of giving directions to group to be tested. Precautions to be observed.

Next we should consider the directions to be given to the group to be tested. We should determine the method of giving the directions, whether orally or in writing. We must determine upon the order in which the instructions are given, being sure that we give first, the thing we want first, and last, the thing we want last. There should be a statement in the instructions that the order is not to be changed, if that is the desire.

These instructions should include :

What to say first, what to say second, etc.

What to say, what not to say. We should give the teacher the reasons for this, so that in case it is necessary for her to make any decisions at the moment, she may be able to decide wisely in our absence. She will then know the lines of thought that the experimenter is following.

What to do first, what to do second, etc.

What to do and what not to do.

We shall have to decide just what form the directions shall take. Shall the teacher read the directions as they are printed? Where we want absolute uniformity, that is the best way of obtaining it. We may decide that the teacher may give the sense of the printed directions in her own words.

The pupils must not become excited. The experiment should be perfectly normal and ordinary, so as not to arouse excitement or suspicions. The children should be told exactly what we require, so that they will not be under wrong impressions and give us the wrong result.

Precautions to be observed in connection with all these considerations, should also be given, both those to be told the students and those to be observed by the teacher.

- (4) Record to be made of (a) interruption to attention of class or of any considerable number of students by visitors, messengers, storm or rain, accident, discipline, etc.
  - (a) Weather conditions during each successful period of presentation, drill or test.
  - (c) Temperature of laboratory (class room).
  - (d) Condition of ventilation.
  - (e) Missteps in carrying out instructions by slight or considerable variations in form of a definitely planned procedure, as, for instance, the inversion of order or the varying pronunciation of words.

We must not overlook to mention in the instructions that there are a number of things which we cannot ordinarily control, and which are important enough to be disturbing elements in some cases. The teacher should have these in mind and make a complete note of them in her report, stating definitely whether or not any of the disturbances occurred and to just what extent they interfered according to her observation.

(a) The attention of the class or of any members of the class may be disturbed by visitors, messengers, storm, lightning, thunder, rain, snow, hail, accident, discipline, noises of various kinds on the street, street peddlers, organ grinders, street musicians, fire alarms or passing of fire en-

gines, fire drills, parades in the street, and numerous other things. Tardy students may also cause disturbance. Complete note of interruptions should be made at the time, so as to get all of the details before they are forgotten.

(b) Weather conditions.

Weather conditions should be noted for each period, presentations and drills as well as tests. It may be thought that it is not necessary to keep a record of the weather conditions if an experiment extends over a long period, that is, several months, but in the interest of science, it should be done.

A long succession of gloomy days when one section is reciting and a long succession of bright days for the other section may have considerable bearing on the results. We all know that we can work better on a bright, crisp day than on a dull, close day. These conditions may or may not interfere with our experiment; it would depend largely upon the nature of the experiment. However, if there is an unexpected difference, we want to have the exact data before us concerning it.

The teacher should state whether the day was:

bright, dull, sunny, part cloudy, cloudy,  
rain, snow, hail, showers (how long during experiment),  
storm (how long and what kind—terrific or mild, thunder or wind,  
cloud-burst, tornado, etc.)  
humid, damp, sultry, sticky, close,  
clear, crisp, brisk, invigorating.

This information should be stated for the period during which the experiment took place and for the preceding part of the day, if any sudden change occurred, that might have a bearing upon it.

Atmospheric Conditions.

Atmospheric conditions may upset our plans.

Work done in a clear, dry atmosphere, it would seem, has the advantage over work done in a humid atmosphere. The conditions of the atmosphere should be noted, as it might account for differences in results of experiments made at several different places. Sticky, humid days occur frequently in New York City, and make considerable difference to certain pieces of apparatus. The old Remington Typewriter, with its wood key bars, was very much subject to weather conditions. The wood bars used to swell on humid days, and the machines would not work as well as on bright, crisp days. That trouble is now eliminated from the new Remington, as metal is used in place of wood, but it would have been very unfair



to compare a class being tested with these machines on a humid day and a class taking the test under more favorable weather conditions.

(c) Temperature.

The temperature of the class room or laboratory should be taken each day during the experiment. A hot summer day would not be so invigorating as a pleasant fall day. Better work might be looked for in a room where the temperature is 70 F. than where it is 105 F.

Of course, if each section had an equal number of days of the same kind, it would seem logical to say that there ought to be no difference in the results because of this factor. But the days may be so distributed that the one section has considerably more unfavorable days than the other.

Even if each section averaged the same number of favorable and unfavorable days, there might be a difference if for one section the favorable days occurred at the most difficult lessons and if for the other section the unfavorable days came at that time. Not knowing those lessons thoroughly might considerably hamper the students in the work that follows.

Some experiments may be devised that must be conducted under certain weather conditions and no others would do so well.

One may have trouble keeping the temperature of the room at the proper point. In typewriting one cannot accomplish much if the room is cold and the fingers cannot get warmed up enough to be limber. If they are cold and stiff, we do not have absolute control over them and they cannot move fast and accurately.

We must not be misled by thermometers, however, especially in winter. Some thermometers are known to have registered 68 while the students in certain parts of the room complained of the heat and they had grounds for their discomfort. The thermostat thermometer was far from the hottest part of the room, and, of course, the thermometer could not be moved. Neither could windows be opened, for such action would disarrange the delicate thermostat system. If such conditions exist, the teacher should tell what the thermometer read but should supplement it by a statement as to the actual condition of affairs.

(d) Ventilation.

Condition of ventilation should also be noted. A poorly ventilated room cannot encourage the energy that a well ventilated room does, and if one section is in the room on more days when it cannot be properly ventilated, than the other section, it would be a disadvantage which might affect results.

The report should state whether the ventilation is good, fair, or poor, and if the room is close and stuffy, a note should be made accordingly.

(e) Missteps.

Where we have a definitely planned procedure and the instructions are to follow it, the teacher should make a complete note of any missteps in carrying out the instructions or any slight or considerable variation in the form; e. g., the inversion of order, the varying pronunciation of words, having to say a thing more than the number of times called for, or any variations made necessary by the exigencies of anything that might arise.

2. Form—A statement in full detail and in order of steps to be taken in the preparation and presentation of material of test and in full conduct of experiment. (Form).

After all has been determined, the complete procedure for the experiment should be written up, so as to have it in definite form.

## V. CONDUCTING OF EXPERIMENT. (Conducting of Experiment)

1. Under the conditions agreed upon with such slight modifications only as are made necessary by the exigencies of the case.

The experiment is to be conducted under the conditions agreed upon, with such slight modifications only as are made necessary by the exigency of the circumstances. It is very difficult to foresee all the things that are likely to occur in an experiment and therefore it often happens that while the experiment is in process and before the experimenter can be consulted, a decision must be made on the part of the conductor which is not in the plan of the experiment. The conductor should be careful not to make any considerable changes from the outline as laid down, but slight deviations, which will not seriously affect the validity of results, may be made. Of course, a complete memorandum of the variation should be made at the time, so that all the information will be at hand in considering the results, and so that, if discrepancies occur between experiments conducted at various places, it can be determined whether the judgment, made at the time as to the seriousness of the interference, was wise or not.

2. Full, detailed and explicit record of variations from procedure made at the time. Also observations which might introduce varying factors.

Any teacher conducting an experiment should be keenly observant for any occurrences which might have a bearing on the results. She should make a detailed and explicit record of them at the time, because some of the details may be forgotten later. This also applies to any variations, however slight, from the approved plans. Nothing should be hidden, even if it is the teacher's own fault, or the fault of the experimenter. We cannot arrive at proper conclusions unless we know the exact state of affairs.

## VI. REVIEW OF EXPERIMENT AND PRELIMINARY REPORT. (Preliminary Report)

1. A full statement by experimenter and assistants—in person when possible—to Seminar of all information, whether recorded or not, which has bearing, direct or remote, upon interpretation of results and validity of same.

Dr. Suhrie wrote up this outline for use in the seminar. He, no doubt, felt that the matter of experimentation in educational method is in such an undeveloped stage that group judgment would be far better on these questions than individual judgment, and that we would get further with the science in that way.

Hence this outline requires presenting to the seminar in person, when possible, by the experimenter and assistants, a full statement of the experiment, thus having the matter gone over thoroughly and having no hasty conclusions drawn and published as valid. In the seminar the fullest possible information should be stated, both that which is recorded and that which is not, for only in this way, with all the data at hand, can an intelligent conclusion be reached.

2. Tentative outline of scheme for tabulation of data with suggestions as to possible or significant correlations to be found, diagrams to be made and points to be emphasized in writing up.

The experimenter should also present to the seminar a tentative outline of the scheme for tabulation of the data, with suggestions as to the possible or significant correlations to be found, diagrams to be made and points to be emphasized in the formal report.

Some of the experiments which will be outlined in this thesis have been talked over in the seminar but the others have not. It were better if all could be.

## VII. FORMAL REPORT AND PUBLICATION. (Formal Report)

This section is also written with the idea in mind that the seminar will pass on all experiments and this will have to be remembered when reading the following experiments.

1. Preparation of report by individual or committee.

After the preliminary report has been presented to the seminar and the matter has been talked over, the formal report should then be prepared, either by an individual or a committee. If only one person was involved in the experiment, he might just as well write it up, but if the report is a long affair, each one might write up the particular section in which he was involved. Or, if any particular one has the faculty of putting things clearly, etc., the writing of certain sections that particularly call for that ability could be given to that person.

2. Principles governing form of report as determined by the uses to which it is to be put.

The form of report should be governed by the use to which it is to be put. It would be advisable to have three reports—an abstract, a summary, and a detailed report.

There should be a brief abstract for the use of teachers in improving their method.

The summary should be more complete and should be written from the standpoint of the reader. If it is to go to some scientific magazine, then it should bring out the scientific points in detail, etc.

The detailed report should be very complete and concise, and should be written with the idea of serving scientific investigators in the field of experimental research in method. Every detail should be plainly given, so that in correlating the work in the future with other similar work, difficulties in the one may throw light upon the other because all the details will be at hand.

All three of these can be printed either separately or in one volume, and should be in the order mentioned.

Of course, the publication in this elaborate form presupposes that the method of the experiment is sound and that no hitches occurred which invalidate the results. Only by labeling that which really is scientific, will there ever be a science of educational experimentation.

3. Review, criticism, and if need be, complete or partial revision by Seminar.

This report, after having been prepared, should then be presented to the seminar again for review, final criticism, and such revision as may be necessary. This will insure its being presented to the public in the best possible shape.

4. Dissemination of the several kinds of reports by most effective and economical means so as to hasten the development of a science of educational method and favorably affect current educational practice.

It is felt that there is not much use in working out these experiments behind the seminar doors if we do not let the teachers of the country know about them, and, therefore, this heading has been included, under which is to be considered the dissemination of the several kinds of reports by the most effective and economical means so as to hasten the development of a science of educational method, and favorably affect the current educational practice.

It is suggested that for the experiments which follow, the brief abstract might best be published through the business education journals, as it will reach most of the commercial teachers in that way. It might also be presented to the Commercial Teachers' Conventions.

The summary might be sent to such journals as the

Journal of Educational Psychology.

School & Society.

Journal of Educational Administration & Supervision.

The U. S. Bureau of Education might be willing to publish either the abstract or the summary.

The detailed report should be filed with a few of the universities interested in this type of work.

## E. THE EXPERIMENTS

We shall now proceed to the experiments themselves.

### a. TYPEWRITING:

On this subject there will be developed methods of procedure for five experiments.

The first one is on the question of speed and accuracy.

the same time, the same individual may be found in a different position, and the same position may be found in a different individual. This is the case with the position of the head, which is sometimes found in a different position, and the same position may be found in a different individual. This is the case with the position of the head, which is sometimes found in a different position, and the same position may be found in a different individual.

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The position of the head is sometimes found in a different position, and the same position may be found in a different individual. This is the case with the position of the head, which is sometimes found in a different position, and the same position may be found in a different individual.

question arises: "Do these two factors bear an equal relation to each other?"

A ready solution seems to appear when we consider the matter from the demands of the business world. We are preparing the students for business. What does the business man want? Does he issue any regulation that no erasers may be used in his office? Investigation has brought to light only one man who claims he has done this. Undoubtedly, by far the large majority of business offices issue no such regulations. Yet there are teachers in our schools who will not permit an eraser within the classroom, despite the fact that they must know that everyone of their students uses an eraser after he leaves the school. The business man wants either speed or accuracy; he wants the combination. He wants the person who can turn out for him the greatest number of acceptable letters, and by this word "acceptable" he means correctly transcribed and neatly written. He does not care whether the stenographer has used an eraser or not, as long as the stenographer has made a good job of it and has gotten out her day's work. He does not care how many times she has used the eraser. That is the business man's test.

To make the exact conditions of the test it would be necessary for us to measure the number of characters written in a day. Here is the problem: "Can this girl who writes fast and must erase occasionally turn out in a day more work than is acceptable and the girl who writes more slowly but does not have any time erasing?" That is the exact problem, but there are so many factors entering into it that with the slight exception of tempo to which we have already referred, such factors are length of time taken by the time-consuming work, the same or more time occupied by the same person in different work on exercises, the quality of the material, and therefore the care of erasure necessary, and for this we do not know what to do, for the reasons have to do with speed, tempo, etc.

There is no one as yet who teaches this, so we must suggest for the teachers some method of assessing the purpose of teaching.

There is a suggestion of the way of a marking system which may allow some type of the measure of the number of characters written, and without doubt, are yet our purpose of accuracy, rate of speed and accuracy and is the one commonly used in many spelling rooms. The details will be given later.

The next question about the problem is, "Can this problem be absolutely solved?" But the answer is not correct. There is no one effort to give the matter a definite up and down answer. It is a problem.

### b. SURVEY OF EXPERIMENTS MADE.

The search for experiments made in this field has revealed but one, that by Frederick Lyman Wells, "On the Psychomotor Mechanisms of Typewriting," printed in the "American Journal of Psychology," January 1916, Vol. XXVII, pp. 47-70.

### c. Differentiation.

This experiment was undertaken with a broader object in view than the one under consideration, viz., that of inquiring into increasing the efficiency of typewriting on the psychological side. As a by-product the experimenter has made some observations on the relation of speed and accuracy. The experiment was made with two typists as subjects.

The one under consideration will deal particularly with speed and accuracy and is planned for a much larger scale.

### 2. Specific Statement.

This experiment is undertaken to try to determine whether emphasizing speed in typewriting interferes with accuracy or not, and, if so, to what extent.

## II. SELECTION OF LABORATORY

### 1. Groups Chosen.

To conduct this experiment two groups of pupils will be necessary, one to be known as Section A (Accuracy Section) and the other as Section B (Speed Section).

The pupils may be those of any class\*—beginners, advanced students or experts—and the experiment need not be confined to those of any one age. It might be of advantage to see how the experiment works with different classes of pupils, and with pupils of a wide range in age, always being certain, however, that an equal number of pupils of the same class or age is in each section, so as to keep them balanced. It may be that the relation of speed and accuracy is entirely different with pupils of the grades than with those of the high school, and even a wider difference may be noted if we were to test out expert typists, who have been in business

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\*The procedure outlined presupposes that students have at least reached the stage where their speed in typewriting can be tested.



for several years. Therefore, the wider the range of groups tested, the better it would be, provided in each case, complete information on this point accompanies the results.

## 2. Schools Chosen.

a. As implied above, it will be well to test the matter out in as many schools as possible and in several grades of schools, to see whether the result remains uniform or not.

b. The schools should, of course, be accessible to the experimenter as mentioned on p. 36 ff.

c. The necessary co-operation should exist, as referred to on p. 38 ff. The laboratory should be the typewriting room of the school.

## 3. Teachers Chosen.

One teacher should have charge of both groups, to eliminate differences in personalities. She should be the regular teacher for the class and should meet the requirements set forth on p. 41 ff.

# III. CHOICE OF CONDUCTOR

It would seem best to have the regular teacher take charge of the work during the course of the experiment.

# IV. DEVELOPMENT OF A PROCEDURE

## 1. Content.

### General Plan in Brief.

The procedure in this experiment requires that one section emphasize speed while the other emphasizes accuracy. The sections are to be equalized by a series of tests and, at the expiration of the time determined, final tests will be given which are to be compared with the preliminary tests.

## a. Difficulties.

### (1) Tests.

#### Preliminary test.

A preliminary test will be necessary in order to obtain data which will represent the typewriting ability of the pupils at the beginning of the experiment.

#### Equalization test.

An equalization test will be necessary to insure the equality of the two sections in typewriting ability at the beginning of the experiment.

One test can answer the purposes of the preliminary and equalization tests. In designating it, use will be made of the name that indicates the purpose in mind at the time.

If we had a typewriting norm, our work would be made easy by using it, but since we have none, the following equalization test is suggested:

Give the students a ten minute speed test similar to the monthly tests encouraged by the Underwood Typewriter Co., using the same rules and copy matter. Give a series of these tests and on the basis of the number of net words written per minute, classify the students, placing in each section an equal number of students having the same speed, and rating the section by the sum total of all the performances. For instance, if there are four students having 20 words per minute, we shall place two in Section A and two in Section B. Section A would then have a sum total of 40 words, and Section B would have the same, etc.

A ten-minute period seems to be the proper length and is the one recommended by the Underwood Typewriter Co. and used in many schools. In the absence of any better rules, those of the International Typewriting Contest should be used. They are not as scientific as could be desired, but they are objective, at least, and very definite. The penalty is arbitrary but it takes cognizance of the accuracy factor in typewriting.

A series of tests has been suggested. It would not be fair to classify the students on the basis of one test. Very few students show a uniform record in typewriting tests. There is considerable difference between two successive days and even between two tests given during the same period. See Appendix, p. ii, for data regarding this. Any one of a number of causes may be responsible for this variation.

How many tests should constitute the series? The greater the number of tests, the fairer would seem the average. But an unlimited number of tests is undesirable for several reasons:

- I. Time would not permit. No school system could spend several months in a preliminary or final test just for the sake of getting averages.

2. The students would become tired of the matter ; interest would lag ; and it is a question as to whether or not we would really be getting the kind of work from the students that would properly show their average speed.
3. The test would take the form of a drill, and both sections would have had so much of the work alike that the comparatively short time devoted to the experiment would have very little effect. All the tests should be on the identical material to get an average, and that would be drill indeed for both sections.

The line must be drawn somewhere. Three have been chosen as possibly the most desirable number in view of the objections raised above.

The average of the three preliminary tests may then be taken to be considered the speed of the student before the experiment begins.

The average of the three final tests may then be taken to be considered the speed of the student after the experiment has been completed.

The difference between the two would then show what the student has gained during the time the experiment was in progress.

When the question was being considered in the Seminar, it was the consensus of opinion that the average speed should be taken as the basis for these tests and the writer fully agreed with this view. He is now somewhat inclined to think that this may not be the proper thing, favoring the use of the student's best record out of the three as the basis for classification. When asking an athlete for his speed he does not give it in terms of an average but of his best performance. The same is true of race horses ; and experience with typists has shown that they almost invariably give their best record when asked what their speed is. This basis uses the maximum attainment of the typist, and if our purpose is to see how much speed he has gained, it would seem that the maximum would more truly tell the tale. Therefore it is suggested that three tests be given in a series but that the highest speed of the three be used as a basis for classification.

#### Conduct of Test.

The test is conducted in this way :

At a given signal, the students write from copy for 10 minutes. At the end of 10 minutes the teacher gives the signal and all machines stop. The words written are counted. This gives the total number of gross words written in 10 minutes. This total divided by 10 (the number of minutes) gives the number of gross words per minute. The teacher then reads aloud from the copy and the students mark the errors. The errors are counted and multiplied by the penalty, which is 10 for each word wrong.

(Prior to 1918 the penalty was 5 for each word wrong.) The total penalty is subtracted from the total number of gross words for 10 minutes and this gives the total number of net words for 10 minutes. Divide by 10 (the number of minutes) and we get the number of net words per minute—the important figure and the one by which the student is to be rated. For example: One has written 750 words; 750 is the total gross for 10 minutes; dividing by 10, one gets 75, which is one's gross speed per minute. Suppose one makes 4 errors; multiply the 4 by 10, the penalty, and one gets 40, which is the total penalty. Subtract the total penalty from the gross (40 from 750) and one gets 710, the total net words for 10 minutes; dividing by 10, one gets 71 as the net number of words per minute. We say that one's speed is 75 words gross, 71 words net, per minute.

The papers should be marked in this way by three different students to insure care, each student signing his name to the paper.

This is very definite and very objective, and something that is exactly understood in typewriting circles.

The International Typewriting Contest Rules, under which this test is conducted, are given in the Appendix, p. i ff.

A more accurate way of calculating typewriting speed would be by movements rather than by words. Words are of such varying lengths that they would seem to afford no accurate method of measuring. And yet, on investigation it develops that the material used in the International Typewriting Contests is surprisingly uniform in the long run. While there may be some lines that contain 20 words and others that contain only 10 words, when it comes to 500 words, they cover very nearly the same number of line (see Appendix, p. ii or iii), and therefore there is not so much variation as would appear on the face.

Mr. Sherwin Cody, Managing Director of Business Standards Association, New York City, has devised a method of counting stroke-words. He says, "The average word in ordinary business letter writing is a fraction over four strokes and for convenience I have adopted the standard stroke-word of four strokes and with one space. This makes five strokes." One of the test letters sent out by the Association, containing 200 stroke-words, totals 184 actual words. A page of the International Typewriting Contest material, taken at random, was counted and found to contain 507 stroke-words and 551 actual words. Counting stroke-words requires considerably more time than the other.

#### Final Test.

A final test will be given at the conclusion of the experiment to ascer-

tain the speed of the students at that time. The test will be similar in all respects to the preliminary or equalization test—the same number in the series and the same copy.

(2) Preliminary Conferences.

As the procedure for the experiment is not difficult, it will not be necessary to have extended conferences with the school officials. Complete instructions could very well be sent by mail.

(3) Other Difficulties.

Procedure with knowledge or without.

Another question that faces us is: "Shall the students be told the purpose of the experiment, etc., or shall they not?"

Undoubtedly it will be found that something must be said to the students. They will ascertain that there is a difference in the work of the two sections and will begin to ask and then form suspicions of their own. So the teacher might just as well tell them frankly at the beginning and thus avoid further questionings. The first time the present experiment was conducted an attempt was made (on the recommendation of the Seminar) to proceed without telling the students anything, but it could not be done, and, finally, with the consent of the Seminar, something was told them.

Therefore, when trying the experiment again, the classes were told at the start, "We are now going to pit the two sections of the class against each other for six weeks, and we are going to see which section can come out ahead. Your section will be given work slightly different from the other section." That was sufficient information to satisfy the great majority and things proceeded nicely. One class even became very indifferent to the information, whereas if they had not been told, they would likely have kept asking until something had been told them.

The chief reason for the Seminar not wishing anything said was that they felt that if the students got the notion that the determination of the future policy rested upon the experiment and that the school would introduce the one which showed up best, they would work according to their own prejudices and would see to it that the method they disliked did not succeed, irrespective of its merits. But the way to bridge this difficulty lies in not telling them too much; i. e., they should not be told that any future policy depends upon it, but it may be said that this is being done in connection with work at the University, which immediately satisfies many.

b. Time.

The experiment could be undertaken at almost any time when vacations do not interfere.

c. Periods.

The precautions laid down on p. 56 ff. should have consideration in determining the periods for this experiment. Typewriting is not work that requires much concentration, to be sure, but yet if one section has more favorable periods than the other, this factor may cause a difference in the results.

d. Subject-matter.

For the tests, any non-technical matter would be suitable. The copy used in the International Typewriting Contests and the monthly Underwood tests would be thoroughly satisfactory. Both of these can be obtained from the Underwood Typewriter Co.

For the regular class work, during the experiment, the typewriting text book in use at the school would be suitable for the accuracy work. Any of the material suggested for the tests could be used for speed work. Of course, it should not be the identical thing used in the preliminary or final tests.

e. Details of Procedure.

Details in General.

Each of the classes will be divided into two sections. They will be known in the school as Section A and Section B. That group of each class which devotes all its time to accuracy we shall call the Accuracy Group; and that group which devotes part (say half) of its time to accuracy and part of its time to speed (i. e., it is emphasizing speed) we shall call the Speed Group.

While each is doing the accuracy work they will both follow the identical schedule; the only point of differentiation will come on the speed days.

While a group is devoting its time to accuracy it will do the regular typewriting exercises of the class.

Accuracy will be emphasized by not permitting the student to pass to the next exercise until he has presented an absolutely perfect copy of the previous one. As already explained, one group will be required to follow

this procedure all the periods during the week, while the other group will be required to follow it only part of the time.

While Section B is devoting its time to speed, it will be conducted as follows:

The copy used in any of the International Typewriting Contests can be used as subject-matter. The class will be instructed that for the period they will do speed work—they will write just as fast as they can without becoming careless, but yet paying no attention to errors. They will not stop to correct errors.

For the purpose of creating some interest, various ones of the class may be selected as pace-makers. The choice is usually made from among those near the head of the class for speed. At a given signal all will start at a given place in the copy and write until the pace-maker reaches the bottom of the page, say. He is told to raise his hand as a signal when he has reached the bottom of the page. Then time is called and notes are compared to see how far each student has gotten. By way of variety it may also be done this way: Each student will write just as fast as he can. The first one reaching a certain point in the copy will raise his hand. Then time will be called and notes compared. Another slight variation will be to write for 5 or 10 minutes and see who gets the furthest. In this way the students will work at top notch speed.

#### (1) Copies of Instructions with Precautions.

The copies of instructions given to the helpers should give the details of procedure.

The copy matter used in the tests should be put out of reach of the pupils, so that no one can use the copy for practice.

The teacher should see to it that no student in the experiment does any typewriting outside of the regular typewriting period. It would be unfair if some of the students were permitted to come into the typewriting room for practice after school during the period of the experiment. Care must also be taken to see that no student uses a machine outside of the school during the progress of the experiment. In other words, the time element must be kept the same for all the students in the experiment. Otherwise that permits another varying factor which would absolutely invalidate the results. Only by permitting each person the same amount of practice can the results be expected to show anything valid.

#### (2) Time Limits.

The next thing to be considered is the length of time that is to be devoted to the actual experiment. Regarding this we can give certain broad

statements only. It would appear that the longer the period of the experiment, the better. But we can hardly find a school system that would be willing to devote a whole year to the experiment. The danger of putting one section at too great a disadvantage over the other must be considered. It is questionable whether or not a teacher could keep the students of both sections working at top notch for so long a period. Some would become disgruntled and not do their best, and that, of course, would bring in a factor that would destroy the validity of the results. For valid results, we assume that both sections are working at a high point of efficiency, and that there is no such disturbing element as antagonism.

The question as to the time that can be devoted to the experiment will depend largely upon the period the authorities are willing to give. West Chester tried it for six weeks because that was all the time it was felt could be devoted to it. This, together with the preliminary and final tests, made it a matter of more than two months with some of the classes, depending upon the number of times they recited during the week.

In setting aside the time one wants to be sure that there will be no such disturbing elements as an extended vacation occurring in the middle of the experiment; for instance, Christmas vacation or Easter vacation. The experiment would better be tried between these two vacations so that they will not interfere. The preliminary tests would best not be conducted at the first recitation after returning from the Christmas vacation, for the students' fingers will be stiff and the tests will not be fairly representative.

### (3) Form, Order and Method.

There is no particular form, order, or method of giving directions in this experiment. The teacher may use her own words to make the matter clear to the students.

(4) Record should be made of any interruptions, etc., as mentioned on p. 59 ff.

### 2. Form.

The balance of the outline covers conditions which are very general and apply to all the experiments. Since they are given fully on p. 62 ff., it will not be necessary to repeat them here.

### a. TYPEWRITING.

Experiment No. 2. The Proper Age at Which to Begin Typewriting.



## I. FORMULATION

## 1. Introduction.

## a. General Statement.

Among the numerous unsettled matters of the typewriting room is the question of the most advantageous age for beginning the study of Typewriting. The subject is now taught in many of our high schools. The question of teaching it in the junior high school has come up. Some schools are already teaching it in the grades. Is it a subject that the pupils in the grades or in the junior high school can learn economically? By "economically" is meant obtaining the proper returns for the amount of time and effort spent on the subject. We get "yes" and "no" for the answer. At any rate, what is the proper age at which to begin the study of Typewriting, or at what age is it most economical to begin the study of Typewriting?

## b. Survey of Experiments Made.

The search for experiments has revealed nothing along the line of the one under consideration.

## 2. Specific Statement.

This experiment is undertaken to try to determine the age at which it is most economically advantageous for a person to begin the study of Typewriting.

By "economically" is meant getting the most returns for the amount of time expended. Effort, of course, may enter as an offsetting factor. We find pupils who are very ambitious and put forth a great deal of effort. Others put forth very little. But these are rather the extremes. The majority of students in a typewriting room, we can say, put forth a normal amount of effort, and that is what we take for granted is being done. Of course, if a child puts forth an unusual amount of effort, he will accom-

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\*This, of course, is not the only question to be solved if we are going to take pupils into the typewriting room from the grades. There is the question of how are we going to stretch out the subject over 5 or 6 years. The students must have it in their senior year to be in shape when they get out into business. Special equipment will have to be furnished, which means added expense. The machines in the high school cannot be used. Seats are too high and the feet of the grade children will dangle. Drop-top desks cannot be used or the teacher will have to open the desks for many of the pupils who do not have sufficient strength.

plish more in an hour than otherwise, but reference is made to the general run of students. If we know what to expect for the general run of students, the exception must then either outstrip them or fall below their record.

## II. SELECTION OF LABORATORY

### 1. Groups Chosen.

For this experiment pupils of various ages should be chosen. It would be well to have groups with two years intervening between them. If we take groups with only one year's difference, it might be difficult to get the required number whose birthdays are close enough to really make a difference in the groups. For instance, if a child were 10 years and 5 months old and another were 10 years and 7 months old, putting the one into the 10-year-old group and the other into the 11-year-old group (classifying them according to their nearest birthday) would not give us much of a difference in the groups. On the other hand, if we were to disregard the months and simply take into consideration the years, then the 10-year-11-month-old child would not be far enough from the 11-year-1-month-old child to place them in separate groups, and we would have the same difficulty. Therefore, by making the difference two years, we are more likely to be able to get different groups.

The next question is: How near should a pupil be to the year set for the group and still be included in that group? It is rather difficult to set a definite age; for instance, to say 3 months and then rule out someone who is a day or two outside of that limit. For the purposes of the experiment, to be sure, the person of that age would answer just as well as the one coming entirely within the limit. Possibly the best that can be done is to lay down some broad principle and then let the experimenter decide each individual case that gives trouble.\* It will likely be agreed by all, that no one of the intervening year should be included. For instance, if we make groups of 8, 10, and 12 years, the students of 9 and 11 years should be excluded. Or, it might be worked this way: Let the groups contain those a half year each side of 8, of 10, and of 12.

After having decided the range of each group, let us say 2 years, it will then be necessary to ascertain how many groups are to be included in the experiment. Since the object is to determine the most suitable age, the

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\*Of course, all this should be noted in the write-up of the experiment, so that if any variation is noticed, some facts may be at hand, which can be searched for a cause.

experiment should include as large a scope in this direction as possible. Therefore, it would seem wise to take a group from the youngest teachable age for typewriting, let us say 10 years old.‡ We also want them just as old as they can be obtained. So let us take these from the high school, which might give us some 18 years of age. This then would give us 5 groups, viz., 10, 12, 14, 16, 18 years of age, respectively.

These groups should be as large as possible, keeping the number in each group uniform. The groups will be designated as follows: the 10-year-old group, the 12-year-old group, the 14-year-old-group, the 16-year-old group, the 18-year-old group.

It may not be possible to get as many in the 18-year-old group as in the others, but even if only a few can be secured, it would be better to include them than not to have any of that age at all. The results need not necessarily be included as part of the findings of the experiment, but on the other hand they may throw some interesting light on the matter.

The students making the highest marks (say 90 and above) would afford the most enthusiastic material for a teacher to work upon, and it is suggested that these be the ones used for the experiment. They can be selected without much difficulty, and if it is found that the younger groups are not making the progress that the older groups are, we can safely say that mediocre and poor students from the same groups will not make any more progress.

If we are going to take all the students as we find them, it will be necessary to give an intelligence test for there are likely to be mental defectives among the younger ones, and, according to word from The Training School at Vineland, N. J., they have had no success with this kind of work.

## 2. School Chosen.

a. The school chosen will, of course, have to be one that is equipped for teaching typewriting, and the experiment will take place in the typewriting room.

### b. Accessibility.

The school should be accessible to the experimenter, as explained on p. 36 ff.

### c. Co-operation.

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‡This experiment was tried in West Chester, Pa. In talking the matter over with the grade teachers from whose classes the prospective students were to be taken, it was found that they agreed unanimously and positively that ten years was as low as they would advise taking anybody into this experiment. They felt quite certain that it would be useless to work with the 8-year-old pupils. The 6-year-olds, of course, do not know how to read and write, and we could not consider them for the experiment.

It should also be a school where the co-operation of all concerned can be assured, as explained on p. 38 ff. Without co-operation on the part of the grade teachers and the students, it may result in not having a sufficient number present during the whole experiment to give results. A teacher may on slightest provocation detain the pupil after school. The pupil may make it necessary to be kept in. (This is assuming that the experiment is to be conducted after school.)

### 3. Teachers Chosen.

The teacher in charge of the experiment would best be the experimenter himself.

If it is necessary to place someone else in charge of the experiment, then a teacher should be chosen, who, because of her ability, can be depended upon to carry out the experiment successfully. See p. 41 ff.

## III. CHOICE OF CONDUCTOR

As mentioned above, the experimenter would be the most desirable person to conduct the experiment, as he is, it is assumed, in possession of the most complete information on the subject of the experiment, and can most wisely make quick decisions on points of emergency that arise during the performance.

See p. 44 ff.

## IV. DEVELOPMENT OF A PROCEDURE

### 1. Content.

#### (a) Difficulties.

#### Equalization Tests.

It is assumed that each of the pupils is beginning with zero ability in the matter of typewriting, but are we correct?

Of course, one factor in typewriting is nimbleness of the fingers. So far as this is concerned, we may have considerable variation at the start, which must be guarded against. But this condition can be met very well, by insisting that none of the pupils who have done anything that would give them nimble fingers, such as piano playing, violin playing, etc., be admitted to the experiment.

It would be profitable to permit these students to take the work, but their records must be kept separate from the others. A comparison would tell whether or not we are justified in excluding them.

Conducting the experiment on a large scale would eliminate any other individual differences.

#### Final Tests.

At the conclusion of the experiment a series of speed tests should be given similar to those in Experiment No. 1, explained on p. 71. The same material, time, and method of scoring should be used, with this exception: namely, that if the progress made by the class has not taken them beyond the use of the shift key and punctuation marks, the students should not be required to use these in writing the test.

#### (2) Preliminary Conferences.

If the experimenter does not do the work himself, he will have to conduct preliminary conferences with the teachers, and if he uses assistants in a large room where he has charge, it will be necessary to have a conference with them.

#### b. Time.

The time element will be uniform. Of course, it is to be expected that the 18-year-old pupils will be able to cover more ground than the 10-year-old pupils in a given time. We have a choice of varying either the ground covered or the time devoted to the work. It would be much more difficult from the standpoint of the experiment to keep the ground-covered element the same; it would be easier to keep the time element the same.

Furthermore, one of the factors in teaching typewriting is the time element, and that should be considered in pronouncing judgment upon a person's ability to acquire skill in typewriting.

By choosing non-commercial students, the experiment could be undertaken at any time of the year, and any day or days could be used unless certain days contained something unusual in the program which might prove disadvantageous to those taking the work that day.

It would be better, however, if lessons could be given every day, so as not to permit any intervals that may be too great to do efficient work.

#### c. Periods.

All of the students could be taught in one section, if the typewriting room is large enough. Then any period of the day would answer our purpose.

It would not be detrimental to the experiment, however, if the students are taught in sections. The instruction given could easily be kept uniform. The chief factor is the practice done by the student himself, and he can do

that as effectively whether there are three others taking it with him or 30, and whether they are the same age or not.

If they are taught in several sections, the periods would have to be so chosen as not to place any section at an advantage over the others. See p. 56 ff.

A bad feature to this experiment will be caused by the fact that the children of the grades may have to take the work after school, at the end of their day, a time when they may not be in the most enthusiastic state of mind. Yet the novelty of the change may keep them in good spirits. In West Chester volunteers were tried and they showed no fatigue when the period began at 3.35 (school dismissing at 3.30) and showed no signs of even a lack of interest during the 40 minute period. The pupils were, however, all of high grade, being those making 90 and above in their regular work.

All students should take it at the same time of day, the program preceding being approximately equal. If the grades take the work after school, the high school students should take it at that time also.

The length of the period should be whatever the school requires for the regular typewriting classes. Three-fourths of an hour is used in a great many schools—possibly in most of the schools in the country.

d. Subject-matter.

The pupils ought to be taught whatever is given in that particular school to beginners in typewriting. It ought not to make any difference what typewriting manual is used, as long as the manual used is a good one and as long as all the students use the same manual. The teacher, of course, will have to use simpler words in her explanations to the younger students than to the high school students; aside from this, the method of teaching would be the same. It does not seem wise for the purposes of the experiment to give more than the minimum essentials of the mechanical details. For instance, "Cylinder stop spring lever," etc., would engulf the 10-year-olds. Most of the time should be spent on actual typewriting.

Touch typewriting is the method used in most of the schools of the country and should be taught in this experiment.

It might be well to measure the progress at different stages, say every two months, to see whether the advance of the one group over the other steadily follows any given ratio.

This could be done by the speed tests described in Experiment No. 1, p. 71 ff.

Since each student started at zero ability in typewriting, his gain is eas-

ily measured by the average speed which he has at the time the experiment closes. Possibly it would be better to take the maximum speed, as explained on p. 71 ff.

Of course, it is impossible to say in advance what the result will be and, therefore, how the results should be interpreted. If, however, it should be found that any one group is considerably ahead of the other groups, we can rather safely assume that the age of that group is a better time to begin the study of typewriting than that of any of the other groups. If there is not very much difference, the question would still be an open one and could only be determined by further experimentation. The question may arise as to what is meant by the word MUCH in the preceding sentence. It would be difficult to state definitely, so that it would hold in all cases, and, therefore, each experimenter must decide that for himself.

If there is no more than 5% or 10% difference between any two of them, it would seem safe to say that there is no difference. If there is 100% difference between any two of them, all would likely agree that there is an actual difference in favor of one group over the others.

No conclusions should be hastily made. The experiment should be tried several times with different sets of pupils, and if the result remains uniformly the same, it will then be safe to assume that the results are valid.

After the experiment has been tried by using the best pupils, it might be tried out on the poorer pupils, or on the mediocre ones.

If it could be done on a sufficiently large scale, it would be interesting to take the students as they come, making no distinction except to see that none of them had any special training in the way of limbering their fingers, and even this condition might be waived.

If these experiments show no appreciable difference, then the procedure should be examined carefully, for, on *a priori* grounds, it does not seem possible that the same result should be obtained if all the groups are on the same basis except as to age.

#### e. Details of Procedure.

##### (1) Instructions and Precautions.

If this experiment is given in a large typewriting room, the experimenter may wish to have some assistants present. They should be handed a copy of the instructions. There are no special directions, however, except that simple language must be used for the younger pupils. Otherwise, what holds for the one group, also holds for the others.

None of the students, of course, should have access to a typewriter out-

side of the regular periods assigned to them, that is, the time element must be kept uniform.

(2) Time limits.

The time limits should be fixed before the experiment is undertaken, at least, tentatively. The beginning date can be fixed definitely, but possibly not so with the concluding date.

The time to be covered by the experiment is a difficult question. Shall it be two weeks, which would be ten lessons; or two months, which would be 40 lessons; or 4 months, which would be 80 lessons?

In some schools typewriting is given twice a week during the first year, and for nine months (barring holidays and vacations) this would give 72 lessons. Two months' work, then, reciting once a day, would be the equivalent of half a year's work at a school of this kind. That might be a satisfactory period. Of course, there is no objection to making the experiment cover a year's time, if it can be done. This would be much better, for 72 lessons ought to bring out any differences, if great differences exist among the groups.

It may be that at certain stages in the learning of the subject, pupils of certain ages may advance more rapidly than others. From the practical viewpoint we are interested in the permanent results— which group will permanently find it the most advantageous. The longer the experiment could be continued, the more accurately would the conclusion answer our question. It might prove very illuminating, however, to keep record of the progress at the different stages. Progress, of course, would likely be interpreted according to the custom of the school in which this is being done. It might be rather indefinite and might need defining.

It might be argued that it is very essential that the length of the experiment be just right, for, if the period is too long, all, irrespective of age, would do fairly well; and if it is too short, so little will be produced that all will do poorly. This holds in many experiments, but it does not appear to carry much weight in the present one. The longer this experiment is continued, the better, it would seem, would be the conclusion, because we are after permanent results, and if there is only a temporary gain of one group over the others at an unknown point, we would be more likely to have gone beyond it, the longer we do the work. Typewriting practice is not quite like drill in some other subjects. In typewriting it is a continuous drill and the limit of efficiency is never reached.

(3) Form, Order and Method.

No particular directions are necessary. See p. 58 ff.



(4) Record, etc.

See p. 59 ff.

2. Form.

The balance of the outline applies uniformly to all experiments and is fully covered on p. 62 ff.

a. TYPEWRITING.

Experiment No. 3. Typewriting Norm.

## 1. FORMULATION

1. Introduction.

a. General Statement.

A most valuable thing for the typewriting room would be a measuring stick, a scale, a norm, by which it would be possible to tell whether or not any student of typewriting is progressing as well as the average person in his group. Of course, a still better thing would be to have some means of determining whether or not the student is progressing as rapidly as he should, but to determine that takes in so many factors which we are unable to handle at present (for instance, his mental ability, temperament, disposition, perseverance, etc.), that it would seem wise to attempt nothing more than to ascertain what the average student does attain at given periods. Or, if any one objects to the words "average student," let us put it this way: we would like to know what most of the students of the country are doing. We could at least have the satisfaction of knowing whether we were in their class, above them, or below them. That is, at least, more than we know now. Even this would be a great help. It would be something objective and would do away with the subjective phase of the question. It would be another addition to the group of measuring scales already provided for several of the branches, such as arithmetic, spelling, penmanship, English, modern languages, etc.

We shall not consider producing a scale for measuring what the progress of a student *SHOULD* be. We shall leave that to the future. We shall simply attempt to find what the average student at present *DOES* attain.

b. Survey of Experiments Made.

The search for experiments has brought to light information on one that was being conducted by William A. Cook at the University of Colorado.

c. Differentiation.

The plan differs in the following respects from the one herein proposed:

Only the students who have one-half unit or more credit and are present on the day of test, are to be included.

All tests are to be taken in the presence of the Visitor.

The papers are to contain a statement of the periods of practice already had by the writer, but nothing is said about the intervals.

The scoring differs from the International Typewriting Rules in that the penalty is not uniform for all errors.

The rules are not clear as to whether the tests are to be taken monthly by each student or only as often as the visitor comes to the school.

2. Specific Statement.

This experiment is undertaken to try to produce a typewriting norm, that is, to determine what progress the average student in typewriting does make at stated periods.

## II. SELECTION OF LABORATORY

1. Groups Chosen.

For this experiment it will be necessary, of course, to take all grades of pupils. We want to know what the pupils who take typewriting are actually doing. We cannot, therefore, pick out a group of excellent ones, and hold them up, because that would be too high for the majority of pupils to attain. It would be far more satisfactory to take the pupils as we find them under actual teaching conditions and ascertain how much progress the majority of them have made at the end of one month, at the end of two months, at the end of three months, etc. A month would seem to be a good dividing point, since our marks in school are, as a rule, figured by months. We could make a month actually 20 school days, as is the meaning of school month in many places.

It would seem as though some differentiation should be made in the pu-

pils. Not knowing what age is best fitted for starting the subject of typewriting, it would hardly seem most scientific to take mixed groups. It would be a good deal better to keep separate records of pupils by ages. This would not necessitate re-arranging classes. The classes may be conducted as they normally would be, but separate records should be kept.

Or, a record of the students should also be kept according to their year in high school. For instance, if we could say that it is found that the average person beginning typewriting in the junior year in high school attains a speed of 10 net words at the end of a month, it would be more definite than saying that for pupils beginning typewriting the average speed at the end of one month is 10 net words, for the reason that in some of our high schools a two year commercial course is given, and typewriting is given in the freshman year, which corresponds to approximately 14 years of age or less, while in some others where a four year course is given, the students do not begin typewriting until the junior or senior year, which would be about 16 or 17 years. Furthermore, some of the seniors may be 18 while taking typewriting for the first time, and if it should be found in the experiment on age, that there is very much variation between the 18-year-old beginner and the 14-year-old beginner, general figures, without reference to age, would not mean very much. Inasmuch as we are still somewhat at sea in the matter, it would seem best to keep complete individual records, each record to show the year in high school during which the study was begun and also the age of the student at the time of beginning. When all the results are turned in, it would be well to group them both according to age and high school year. We could then say that for the students beginning typewriting in their junior year at high school, we find the average speed at the end of a month to be so many net words, and for the students beginning typewriting at the age of 16, we find the average speed at the end of a month to be so many net words. This would give us definite information and we could then use whichever we find to be the most desirable for our purpose.

It might be that these figures present a problem, in that when considering the speed of a 15-year-old beginner it may be 10 words, and when considering the sophomore in high school it may be 15 words. We may wish to ascertain what the progress of a certain 15-year-old sophomore should be when compared with what is done over the country at large and find that a sophomore should have a speed of 15 words and that a 15-year-old boy should have 10 words. Which figures shall we take? For the decision of this question we must wait until we know something about the ability of students at different ages. If we find that there is much differ-

ence between the ages, then it would seem better to use the scale based on ages. If we find no difference in the ability at different ages, we will simply have to say that we have no scientific means of knowing which of the scales to take. This, however, may be found out later, and so it would not be worthless to try the present experiment. It would simply be a question of having two scales and not knowing which is the more accurate of the two for our purpose. Each would give this much satisfaction at least: we would know that according to the one basis, certain things obtain, and that according to the other basis, certain other things actually obtain. We would have to decide whether we wished to use either of these or neither.

Another factor might enter into this situation, and that is the question as to how often the subject is taught. It may be that a student having had twenty typewriting lessons, taking them twice a week, would not have the same speed as a student having had twenty typewriting lessons, taking them each day for five days a week. This factor will have to be stated in the name of the scale, thus: "Speed in net words, found to be attained by the average 15-year-old pupil taking typewriting twice a week during his junior year." Of course, to have the scales serviceable to all, we should be able to say what the actual finding is for pupils taking typewriting twice a week, three times a week, and five times a week, and if there are any schools giving it four times or ten times a week, they would desire to know what the finding is for that number of recitations a week.

Of course, still another factor enters. One method of typewriting may be more efficient than another, and that will make some students attain better results. But we are not trying to decide what the average is with the best method known (a question impossible to determine, at least at present); all we are trying to say is what we have found to be the average speed attained after having tested out a great number of pupils, and, of course, that will take in many methods, as the experiment should be undertaken on a large scale and should include a great many school systems.

We can then say, as we do with spelling grades, that the average for all the cities tested is so much, the average for New York is above or below that. The average for a certain method which is taught in, say, one or two schools in New York is so much. The average for the classes taught by such and such a teacher is either above or below this line.

## 2. Schools Chosen.

### a. General Character of Student-Body.

A great many schools should be chosen for this experiment and they

should be schools from a great many cities—the more the better—because we want to find what is actually being done today in the representative or the larger schools of the country where we can assume that the teaching is being done intelligently. Of course, this will include all sorts and conditions of students, good ones, mediocre ones, and poor ones. It will include those who have had their fingers limbered up before taking up the subject, and those who have not. It will include those who do only as much work as called for in the class room, and those who do extra work. We are not trying to differentiate here. We are simply trying to ascertain what is actually being done under the ordinary conditions that now exist.

b. Accessibility.

All the schools tested need not be accessible personally to the experimenter. He would not even need to visit them. All that would be necessary is to have clearly formulated instructions and be assured that the teachers who are to carry out the instructions understand them and are in sympathy with the idea, so that they give reports of actual conditions and do not color them either favorably or unfavorably.

c. Co-operation.

There must, of course, be co-operation on the part of all concerned, as explained on p. 38 ff., so as to get accurate results.

3. Teachers Chosen.

This would really be more of a survey than an experiment in the narrower sense of the word, and so it would not be necessary to make any change in the teaching staff. We want to know what the teachers are actually doing, and not what they would do under any special system of instruction. We would want to be sure, though, that the person who is obtaining the information for us is thoroughly conversant with the idea in mind and is in sympathy with it, and is professional and scientific enough to see that the tests are properly given and that the records are correctly made, so that they will actually show conditions existing, uncolored by any personal views or wishes.

Even if the actual teacher of the class is antagonistic to the idea, if the experimenter sees that the tests are properly given and she does not influence the students to be abnormal at the time, her antagonism can hardly invalidate the result of the whole experiment.

## III. CHOICE OF CONDUCTOR

By the preceding page it is decided that the regular teacher will conduct the experiment. See also p. 44 ff.

## IV. DEVELOPMENT OF PROCEDURE

## 1. Content.

## a. Difficulties.

(1) No preliminary nor equalization test is necessary.

(2) Personal preliminary conferences will not be necessary. The instructions are simple and could be written out so that no teacher would have any trouble in following them. They could be sent to the various schools by mail.

(3) Any other difficulties.

To carry out this experiment it will first be necessary to find a number of schools with typewriting students aggregating a thousand or more (the more the better) who would be willing to assist in getting the necessary data.

After having found the schools, it will be necessary to make sure that some one in each of these schools will make himself or herself responsible for carrying out the instructions properly. In the larger school systems, it is likely to be the head of the department or the supervisor. In the smaller schools it would likely be the principal or the teacher herself.

The instructions as to how the experiment is to be carried on should be written out in full detail and copies should be in the hands of the teachers. The experimenter should be very careful to have the instructions so clear and complete that there will be no misunderstanding about them.

## b. Time.

The experiment should start at the beginning of the school year—September, in most cases—and it should include all the students taking typewriting, both the beginners and the advanced students. In reporting the advanced students, the details should show how old they are at present, in what class and how often they are taking typewriting during the week. It should also show data on their past typewriting performance, such as how many years they have been typewriting, in what class of the high school they began the subject, their age at that time, how many times a

week they took the subject, and how many weeks in the school year. The length of the periods should also be mentioned.

c. Periods.

It might also be well just for the sake of making individual comparisons, to state at what time of the day the recitation took place and what immediately preceded it. Of course, the tests will take place during the regular typewriting periods.

d. Subject-matter.

The subject-matter will be the regular typewriting instruction given in that particular school for that particular class. We are trying to find out what the average is for all the systems and schools and methods. It can be assumed, however, that touch typewriting is being taught. Mention should be made if it is not the method.

Next we come to the more difficult part of the experiment, and that is the testing.

This, it would seem, should take place at the end of every 20 school days, or a school month. That is a convenient reckoning period in our present practice, and would therefore afford a basis for the month's marks and be practical in this respect.

The tests should be conducted in the manner described for the preliminary and final tests in the first experiment of this thesis, p. 71 ff, using the International Typewriting Contest Rules.

The same copy matter should be used by all students and for each monthly test. Care should be used that the student does not have access to it in the interim.

A slight exception might be made in the case of beginners. Students who are taking typewriting twice a week will not have progressed very far at the end of the first month. According to some methods of instruction they will not have had capital letters nor punctuation marks. For these, a slight variation might be made in this respect: Expect of them only what they have been taught. That is, if they have not had capital letters, allow them to use the small letters in place of the capitals whenever the capitals are called for on the copy, and if they have not had punctuation marks, permit them to omit those called for in the copy. Another suggestion might be in order. If the beginning students have not had any practice in sentence writing, that is, if they have only been practicing isolated words, they should, before taking the test, write for say 10 or 15

minutes from copy in which continuous sentences are given, so that they may become accustomed to sentence work.

The question arises, "How many tests should be given at the end of each month, one test, or several as recommended in the other experiment?"

It will take a great deal of time to give three tests at the end of each month. Furthermore, it will interfere a great deal with the teaching process which we are testing. Our results will then have a disturbing element in them of sufficient proportions to be considerable and therefore, will not properly measure the students who are doing the regular work, which is what we want to test.

Furthermore, in the previous experiment we were not figuring on such a large number of students in the test, and the possibility for individual variation was much greater. In this experiment it is not likely that all of the students will have an off-day each time a test comes along, when it comes regularly once a month, and other subjective factors will not play so large a role.

Then again, in the other experiment we wanted one figure at the beginning and one figure at the end of the experiment, to show the pupil's ability. Here we have a record every month over the whole year's work for the same student. Even in the individual record, one off-day would likely be balanced by the next record, and so on. Progress should be shown by the succession of records made by each student. Hence, it would appear that one test at the end of the month is sufficient, for the subjective factor is taken care of through our largely increased number of tests, as well as the number of students. More tests than one a month, would interfere with the very thing we are testing and so much time could not be taken out of the regular work.

The matter of marking so many papers would also be a serious proposition, and it would seem that the added work would not justify the difference in the results.

It is suggested that each pupil mark his own work, while the teacher reads the copy aloud. Then, have the papers exchanged with a neighbor, and have the neighbor write on the paper, "Checked by ———," and sign his own name. The teacher will again read the copy aloud, while the students mark the papers. The papers will be exchanged once more, and marked: "Rechecked by ———," the student again signing his own name. This should insure a very accurate record of the work and save much time in marking. This method is suggested in Cody's *Commercial Tests and How to Give Them*.

Along with the record of each test should go the following information



for each class, so that if any considerable variation is noticed in one set of papers, we may be able to look intelligently for the cause:

Time of day the test was given.

What the students did in the periods immediately preceding.

Temperature of the room.

Atmosphere, i. e., humid, close, etc.

Kind of day, i. e., bright, pleasant, dull, rainy, etc.

There should also be noted any unusual disturbing elements, such as fire drill, unlooked-for accident, etc., which would disturb the class in the test.

After all this information has been collected at the end of the year, it would require a considerable force to tabulate it. It would be better to collect the material each month and work on it as it comes in. Care, of course, should be used to make the records accurate.

The data should be arranged as follows:

Keep the record for each class separate.

Group the classes of each school.

Group the schools of one city.

Group the cities.

We want the above arrangement according to averages.

Group the papers in the way mentioned above, and from these groups tabulate the following information:

13-year-old pupils beginning typewriting:

List A. Those taking typewriting twice a week.

List B. Those taking typewriting 3 times a week.

List C. Those taking typewriting 4 times a week.

List D. Those taking typewriting 5 times a week.

List E. Those taking typewriting more than 5 times a week, with a footnote showing how often.

Re-group these according to the 13-year-old pupils taking it in the Freshman year, Sophomore year, Junior year, Senior year, in high school.

Make the same kind of a record for the 14-year-old pupils beginning typewriting.

Ditto for the 15, 16, 17, and 18-year-olds.

Then we should make a table showing:

14-year-old pupils taking the second year of typewriting.

Giving as preliminary information what they had the previous year, i. e., the number of periods altogether, whether they came twice, three times, etc., a week.

List F. Those taking it twice a week.

List G. Those taking it 3 times a week.

List H. Those taking it 4 times a week.

List I. Those taking it 5 times a week.

List J. Those taking it more than 5 times a week, noting how often.

Re-group these according to the 14-year-old pupils taking it in the Sophomore year, Junior year, Senior year, of high school.

Make the same record for the 15-year-old pupils taking the second year of typewriting.

Ditto for 16, 17, and 18-year-olds, taking the second year of typewriting.

Then in a similar way take the 15-year-old pupils taking the 3rd year of typewriting, etc.

Then the 16-year-old pupils taking the 4th year of typewriting, etc.

This data should also be arranged in the following manner:

Speed of the students at the periods mentioned below:

Schedule for the students taking the work twice a week:

At the end of 8 lessons,

At the end of 16 lessons,

At the end of 24 lessons,

At the end of 32 lessons, etc.

Schedule for the students taking the work three times a week:

At the end of 12 lessons,

At the end of 24 lessons,

At the end of 36 lessons,

At the end of 48 lessons, etc.

Schedule for those taking it 4 times a week:

At the end of 16 lessons,

At the end of 32 lessons,

At the end of 48 lessons, etc.

Schedule for those taking it 5 times a week:

At the end of 20 lessons,

At the end of 40 lessons,

At the end of 60 lessons, etc.

Schedule for those taking it more than 5 times a week:

At the end of        lessons, etc.

It would also be profitable to have the data in the following form, if we find that many schools follow this arrangement of hours:

Schedule for those taking it twice a week during the first year, 3 times during the second year, and 5 times during the 3rd year.

At the end of    8 lessons.....till    80 lessons.

At the end of  92 lessons.....till 200 lessons.

At the end of 220 lessons.....till 400 lessons.

Also:

Schedule for those taking it five times during the first year and five times during the second year:

At the end of  20 lessons.....till 200 lessons.

At the end of 220 lessons.....till 400 lessons.

In this way a school could readily find at any time, the status of the schools running the same schedule as its own.

(c) Details of Procedure.

(1) Instructions.

Since this experiment covers a wide territory, it will be necessary for the experimenter to make most of the arrangements by mails, and therefore the instructions should be carefully written up so that there will be no misunderstanding on the part of the teacher conducting the work.

It might be well, in sending out the instructions, to state that, if the matter is not clearly understood, the question should be raised on the points that are not clear. The instructions should be put into the hands of the teachers so that they will be available for the beginning of the school year.

(2) It should be stated that the test is to be given at the end of each school month for a year and it should take place during the regular type-writing period.

(3) There are no instructions to be given to the class, and therefore we need not concern ourselves with this part of the outline. If the class is not familiar with the marking system used in the International Type-writing Contests, it will be necessary for the teacher to explain it to the

students. That will in no way affect the experiment itself, however. She can make that explanation in her own words.

(4) If anything occurs to interrupt the test, a note of it should be made in full detail. See p. 59 ff.

(2) Form.

The balance of the outline applies uniformly to all experiments and is covered fully on p. 62 ff.

#### a. TYPEWRITING.

Experiment No. 4. Should We Teach the Touch Method or the Sight Method of Typewriting in Our Schools?

#### I. FORMULATION.

##### I. Introduction.

##### a. General Statement.

It is difficult to say whether or not an experiment on this question is justified. The investigator had thought it was universally granted that the touch method is superior to the sight method of typewriting, which being the case, there is not much use in trying to prove something on which everybody is agreed, especially since there are so many other things on which people are not agreed, which need attention. Not that common opinion is always right and that it is not worth while testing out those things to see whether they are scientifically founded, but a matter of this kind could rest a while with less loss, apparently, than some other matters; and, furthermore, the proof appears to be so self-evident.

However, it is found that there are still some business schools advertising in their catalogues, that they teach both the touch and the sight systems. If it is still an open question, possibly it would not be energy wasted to prove it scientifically.

The point at issue is this: according to the one method the student looks at his fingers while he is writing and according to the other he does not—under the sight method the typist watches his fingers while he writes and under the touch method he does not watch his fingers while he is writing but keeps his eyes on the book or paper from which he is copying.

Teachers in the typewriting room have put it this way to their beginning pupils:

"Now, under the old sight method you would look at your book and read a few words. Then you would write those words and watch your fingers to see that you struck the correct keys. Then you would look at your book again, hunt the place, read a few words, and then write them; and so on. (The teacher would demonstrate while she explained.) But under the new method, the touch method, you keep your eyes right on your book and keep writing at the same time, like this. (Then the teacher would demonstrate.) Only when you reach the end of a line and have to bring your carriage over, do you have to look at your fingers, and then only to see that your fingers are back in the proper place, that is, on the position keys. After a while you won't even have to do that. In this way you save a great deal of time that would be lost in looking on and off, as you would have to do with the sight method. Speed is the thing we are after, and if you can be writing while the other fellow is looking off and on and hunting his place, you will be able to write just so many more words, and that will increase your speed. That is why we want you to learn the touch method."

Someone occasionally objects and says, "Don't you get used to hunting your place and can't you find it quickly after a while?" "Yes," the teacher will answer, "you can find it somewhat quicker after a great deal of practice, but even then, you lose time because you stop typewriting while you read what you are going to write next."

The argument is so evident that a person wonders why the sight method is taught at all, and one difficulty in conducting this experiment would be the apparent unfairness to the section that is taking sight typewriting, for it is almost universally agreed (it is believed this can be said without fear of being contradicted) that the touch system is by far the better. It might be difficult to find a school system that would be willing to permit the experiment to be tried, because from the outset it appears that one section would be at a great disadvantage over the other.

In most experiments we simply do not know which of several ways is the best, and it is a sense of satisfaction to a school system to know for itself which is the best, so that it can be guided accordingly in the future, but where a system takes the stand that touch typewriting is far superior to sight typewriting, it would be hard to get permission to conduct the experiment. But those schools which advertise in the way mentioned above, would seem to be the places to perform the experiment, for they evidently are not absolutely prejudiced in favor of touch typewriting.

#### b. Survey of Experiment Made, and Differentiation.

C. G. Bradford reports "An Experiment in Typewriting" in the "Peda-

gological Seminar," December 1914, Vol. XXII, pp. 445-468, in which some data on Touch and Sight Methods is given, but the experiment does not have for its aim a verdict on the question of Sight vs. Touch. In all, four typists were involved and two of them took the Sight Method at first and then the Touch Method, which brings a disturbing factor into the situation.

William Frederick Book made a study of typewriting, "The Psychology of Skill with Special Reference to Its Acquisition in Typewriting," University of Montana Publications.

For this experiment two of the subjects used the Sight Method and two used the Touch Method.

He has made a very minute analysis of learning to write by Sight and by Touch. His evidence (which is in favor of touch typewriting) is from the standpoint of the learning process; the experiment under consideration seeks evidence from the standpoint of the results obtained, and is to be worked out on a much larger number of pupils.

#### d. Specific Statement.

This experiment is undertaken to try to determine (scientifically) whether we should teach the Touch or Sight Method of typewriting in our schools.

## II. SELECTION OF LABORATORY

### 1. Groups Chosen.

The pupils selected for this experiment should be beginners in typewriting, it matters not whether they are in the junior high school, in the regular high school, or in a business school.

They should be beginners because at the beginning is the place to decide whether they will be sight or touch operators.

They should be of all grades and classes, because one method may possibly affect younger students different from older students and if it does, we want to know it. If it does not, as scientific investigators, we want to know that too.

There should be two sections, one using the Sight Method and one using the Touch Method.

### 2. Schools Chosen.

In this experiment it is our desire to know how the methods work under all conditions and therefore, we can take matters largely as we find them

and do not have to select certain schools because the character of their student body is ideal or high, or because the children of the school come from high type American homes, etc.

Of course, the school should be accessible to the experimenter so that he may observe the conditions and see that the experiment is properly understood by the teachers and properly carried out. See complete reference to this on p. 36 ff.

#### b. Co-operation.

There is very little use in conducting any experiment in a school where the experimenter does not have the co-operation of all concerned. See p. 38 ff. relative to co-operation.

Because of the apparent one-sidedness of the question, we may have difficulty in obtaining the necessary co-operation. The student should be given the choice as to the method. If forced into the section he does not want, he may not co-operate.

#### 3. Teachers Chosen.

The teacher chosen should meet the conditions set forth on p. 41 ff.

We may have to look largely to the business schools for the working out of the question in hand, and we may find difficulty in obtaining teachers who have the scientific attitude, as many such teachers have had no normal training.

#### d. Any Other Reasons.

The same teacher should be in charge of both groups, because otherwise another factor might enter into the experiment in the way of the personality of the teachers.

One difficulty in connection with this experiment may be in getting a teacher who can teach both methods without prejudice.

But the schools which advertise both the sight and the touch method, would seem to be the place to go for help in this direction, for they are evidently not absolutely prejudiced in favor of touch typewriting. We would try first, of course, to get a teacher who could undertake to teach both methods, but if this could not be done (both sections meeting at the same period, for instance, etc.), then it will be necessary to get two teachers as nearly alike as possible—whose personalities have about the same effect upon the pupils, that is, two with whom the pupils will co-operate to

very nearly the same degree (specify in the report which has the greater and which the lesser co-operation, if any), and whose personalities have just about the same amount of force in putting things over to the pupils. If it is hard to decide that any two teachers available are alike or nearly alike, the experiment cannot be expected to give valid results and it would not be expedient to try it because this factor is an important one.

However, the schools in question are business schools and in such schools the students are usually taught individually (not by classes), as the pupils enter at any time during the year. This would make it impossible to conduct the experiment in classes. If it were going to be done in these schools, it would have to be done individually, which, while not absolutely impossible, requires more work and care. The teacher would have to be sure that the instruction given to each individual was the same as that given to others, in effect at least. She would have to be on guard continually. Special care would have to be taken to see that the records of each pupil are taken at the proper date, that is, the tests given at the proper time, so that one pupil will not have had a longer period for the same test than another. She should have a standard individual record for each student, so that nothing will be overlooked.

In the subject of typewriting, however, the teacher does not enter into the matter so largely in some schools as she does in most subjects. Some text books in typewriting are so arranged that the student is merely started by the teacher and then seeks his own salvation, and this kind is very often used in business schools, because of the individual method of instruction. If the experiment is tried in a school where this type of text book is used, we would not have to put so much consideration on the choice of a teacher to conduct the experiment, because it would largely depend upon the pupil himself. We would have to ascertain just how much attention is given by the teacher and be sure that when it is given, it is of the right kind for the purpose of the experiment in mind. A full statement of this in great detail should be made in the report.

### III. CHOICE OF CONDUCTOR

1. The best person to conduct this experiment would be the regular teacher of the class. But inasmuch as the students have not become accustomed to any teacher in this subject, some other person, who had the necessary qualifications, could do it. See the consideration of this subject on p. 44 ff.

2. Agent selected. If the regular teacher is not ideal for any reasons, then we shall have to choose the next best person available. If the only



person available falls short of our requirements by any considerable amount, we shall have to postpone the experiment until we can get the proper person.

#### IV. DEVELOPMENT OF A PROCEDURE

##### I. Content.

##### a. Difficulties.

##### (1) EQUALIZATION TEST.

It is a very difficult matter to equalize sections of a prospective class of typewriting students. All we can do at present is to exclude from an experiment those students who we believe have an advantage at the start through possessing pliable fingers as the result of piano or violin playing.

Aside from this we are not able to isolate any of the factors that constitute typewriting ability. Considerable experimenting will be necessary before we can accomplish this, and, in the meanwhile, our experiments with other phases of typewriting must be conducted on a sufficiently large scale to eliminate what unknown inequalities exist.

#### FINAL TESTS.

Tests are to be given

immediately before the shift key is used,  
after it has been mastered,  
one month after beginning typewriting, and  
each month thereafter.

The first three tests will act as a check on our equalization.

It is not expected that any considerable difference will appear before the first month.

We have assumed that each student started with zero typewriting ability. The number of net words written per minute in the tests will therefore show his progress and will be the basis of comparing the sections.

International Typewriting Contest material and Rules will be used in these tests. See page i ff. for details. Capitalization and punctuation would have to be ignored until the student learns how to do this work.

After the students go out into business, they should be tested each year or half year, if it is possible to get them back to the school for the test.

The point at issue may have been proved conclusively to the students long before this and the one set may have refused to continue their method. If it does run into years, the amount of practice a student has had in business in the course of the year should be calculated as nearly as possible and this taken into consideration in the result. We would expect a difference between the student who worked at the machine all day and the one who worked only half a day. Minutes and seconds would not be considered when we are talking of years of experience in typewriting.

(2) Preliminary Conferences.

Inasmuch as the details of this experiment are not difficult to understand, it will not be necessary to hold any preliminary conferences. The procedure can be easily understood from the written instructions.

(3) Any other Difficulties.

It will be difficult to keep the pupils from doing extra typewriting, that is, from doing it outside of the regular period. The teacher will have to handle the situation very tactfully. It may even be necessary, in order to keep the co-operation of the pupils, to tell them that they will receive no mark on what they do outside, but only on what they do in the class room, and that the basis for marking will be, not the amount of work they cover but how well they do the work in that period and how carefully they follow instructions. It would be very difficult to keep students from doing any extra typewriting for a whole year, if the students are like those of West Chester, Pa., for whom six weeks was too long a period.

Another difficulty may be that if the results show up so much more favorably in one section than the other, it may become apparent to the students themselves and it may be difficult to hold the other section to its plan. It may be argued that this would be proof in itself. It might not be, because sometimes there is a zone where one method (and usually the poorer one) keeps ahead of the other for just a little while, and after a certain point is passed, the other makes rapid, permanently-advanced strides, and the only way to tell is by keeping the experiment going long enough.

b. TIME.

The date for the beginning of the experiment should be definitely set. It must be, by the nature of things, at the time typewriting is begun. If

the subject is conducted by class instruction, the time will likely be September or February. If it is taught by the individual method, of course, it will take place whenever a student is ready for the work.

A test should take place just before the students are ready to use the shift key, another after they have mastered it, and a test regularly each month counting from the day the student begins typewriting.

With the individual method we must be certain to keep an accurate record of dates. The test immediately preceding the use of the shift key and the one after mastering it, will not come at the same time for each student by this method, and there seems to be no way of controlling it. This will not be an important item, however, because his other tests will come at monthly periods, dating from the time he begins typewriting. Most importance will be attached to the monthly tests.

It will be necessary to decide how often the subject will be given and on what days of the week.

#### c. PERIODS.

Both sections should meet, if possible, at similar periods of the day. This can easily be done when the class recites only twice a week, or if the room is large enough to accommodate both sections at one time.

#### d. SUBJECT-MATTER.

The subject-matter is to be the regular typewriting lessons of the school where the experiment is given. It is regular work we are testing out by two different methods. The work should be the same in both sections and any text can be used.

The text used should be mentioned in the report. It would be well to state how much of the text had been covered at the time of each test.

For the tests we can use such material as the monthly tests of the Underwood Typewriter Co., or the material used in the International Typewriting Contests, copies of which are furnished by the Underwood Typewriter Co.

#### e. DETAILS OF PROCEDURE.

##### (1) Copies of Instructions and Precautions.

Among the precautions should be mentioned the fact that special care must be taken to see that the touch students adhere absolutely to touch.

The others will not have to be watched so much because it is more or less *laissez-faire* with them, and there is very little danger of their doing the touch method if they are not compelled to do it.

If the individual method is used, the teacher should be cautioned to see that the tests are taken regularly each month. See p. 83 ff. for further suggestions relative to the details of procedure.

## 2. Form.

The balance of the outline applies uniformly to all experiments and is covered fully on p. 62 ff.

### a. TYPEWRITING.

Experiment No. 5. Should the Schools Have Open or Blank Keyboards on the Typewriters Used for Instruction Purposes?

## I. FORMULATION

### 1. Introduction.

#### a. General Statement.

Typewriters can be had either with the open keyboard or the blank keyboard. An open keyboard is one that has letters on the keys; a blank keyboard has no mark on the keys to indicate what they are. Both of these are used in schools. Some teachers absolutely insist on the blank keyboard and would not tolerate anything else in their class rooms. If these machines are so much superior to the others, that such a positive stand can be taken by many teachers, all of the schools should use them. But why do they not? If there is a great advantage, it should not be difficult to prove it scientifically. That is the purpose of this experiment.

#### b. Survey of Experiments Made.

No experiments along the line of this question have been found in the present research. The Underwood Typewriter Company was asked the following questions:

"Does your Company express any preference with regard to blank or open keyboards? Do you know whether anyone has actually tested the thing out, either on individuals or classes?"

The following reply was received from the Manager of the Educational Department :

"Our Company has no preference with regard to blank or open keyboards. So far as I have been able to learn, schools that have tested the matter out prefer the blank keyboard."

On inquiring relative to the tests mentioned, no further information was obtained.

c. Differentiation.

In view of the above, no differentiation is necessary, as the experiment suggested stands by itself.

2. Specific Statement.

This experiment is undertaken to try to determine whether the schools should use open or blank keyboards on the typewriters used for instruction purposes.

## II. SELECTION OF LABORATORY

1. Groups Chosen.

The groups chosen could be any class of pupils who are beginners in Typewriting. They could be pupils in the junior high school, senior high school, or business school.\*

The class chosen must be divided into two sections, one using the open keyboard and the other using the blank keyboard. The sections do not necessarily have to meet at separate times or places, but the names of the pupils must, at least, be kept on separate lists. There is no difference whatever in the instruction, the only difference being in the typewriter used, and because of this, both sections could be carried on at the same time.

2. Schools Chosen.

a. General Character of the Student Body.

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\*Business School will be used as the term meaning all private business schools, whether they use in their incorporated title the misnomer of Business "College," or the less pretentious but more correct term of Business School or School of Business.

No particular effort need be made to obtain any certain type of student body. We are seeking information relative to the effect that these keyboards have on pupils of various types. Pupils of many classes are taking up the study of typewriting. Whatever class the student may be, he is obliged to submit to the machine which the head of the department or teacher has decreed, whether it be a blank or open keyboard. Therefore, we do not want to discriminate and choose merely one kind of student. If the problem works one way in one school and another way in another, we want sufficient information at hand to decide whether the difference lies in the type of the student or in some other factor. Therefore, the report should give full information regarding the kind of pupils taking the work.

b. Accessibility.

The school should be accessible to the experimenter, as explained on p. 37 ff.

c. Co-operation.

The necessary co-operation should exist on the part of all concerned, as described on p. 38 ff.

3. Teachers Chosen.

The teacher chosen should be sufficiently intelligent to handle the experiment. She should have the scientific attitude of mind and be professionally interested in the results, as explained at length on p. 41 ff.

One teacher should have charge of both sections of the class, so that the matter of personality will not enter as a varying factor.

She should not be prejudiced in favor of either method and must not even express her opinion or choice so that it will reach the students. It will require keen observation to see that the pupils do not look at the keyboard. She cannot be a teacher who does not see things that transpire. She should not give more attention to one section than to the other.

### III. CHOICE OF CONDUCTOR

The regular teacher will generally be the person who would be most likely to conduct this experiment, although anyone else having the necessary qualifications could do so, since it comes at the beginning of a subject before the students have become accustomed to any one particular person.

## IV. DEVELOPMENT OF A PROCEDURE

## 1. Content.

## a. Difficulties.

## (1) Equalization Test.

## Final Tests.

What has been said under Experiment No. 4 in this regard, also applies in this case. See p. 101 ff.

## (2) Preliminary Conferences.

What has been said in the above mentioned Experiment under this heading, applies here also. See p. 102 ff.

## (3) Any other difficulties.

We must be on guard so as not to confuse the point at issue in this experiment with anything else. We are trying to decide which keyboard is the better for touch typewriting. We are not trying to decide whether touch typewriting is better than sight; that is the subject of an experiment by itself. If we do not keep close check on our thinking, we may find that at the knotty points, we run into the other problem.

The requirements of touch typewriting must be taken into account at all times. The teacher must constantly be on guard to see that none of the students watch their fingers during the regular practice periods or at any other time. If a teacher finds that she must keep closer watch on the students who have open keyboards than on the students who have blank keyboards, it should be a consideration in deciding the matter of the value of the one as against the other. Therefore, the teacher in this experiment should be very observant and make record of her efforts in keeping students to the things they should do. Her record should show the number of times each student has not used his eyes properly, whether she has actually been able to speak to him individually each time regarding it or not. This record would at least prove very interesting as a side light, if not as the chief evidence in determining a question of this kind. She could have a list of the names of the students with columns opposite, wherein could be noted the number of times she is obliged to speak to each student each

day during practice, because of watching the keyboard. This information should be tabulated for each section.

One considerable difficulty will be that of determining the basis for our conclusions.

We have three kinds of data in this experiment, that could be used in determining the value of the open keyboard as against the blank one:

We could determine it on the basis of the effort necessary on the part of the teacher, to produce touch typists with each kind of keyboard.

We could determine it on the basis of the student's ability to do the touch typewriting during a test.

We could determine it on the basis of the speed attained by the student.

The last basis would not be absolutely correct. Up to a certain point it is to be expected that sight operators make better speed. If the students using the blank keyboards make better speed than the others, it would be important, but nothing could be inferred as against the blank keyboards, if the speed of the pupils using lettered keyboards was better, because this experiment is not planned to run over a sufficiently long time to consider permanent speed. It is simply a temporary speed that is being recorded, which is believed by many to turn in favor of touch typewriting after a certain point—the point where looking off ones copy loses more time than watching ones fingers gains.

The second basis would be a method that would economize the teacher's time, and yet would seem valid. The strain of exceedingly careful watching would last for the period of the test only. It would seem to be fair to the student, nevertheless, because if the student did touch typewriting, he should be able to demonstrate it in a ten-minute test. It would be interesting to notice whether or not the student changed his tactics in succeeding tests.

The first basis would require the most work on the part of the teacher. She would be required to keep an accurate record of each occasion on which it was necessary to speak to the student about watching his keys, whether she actually did speak or not. This would seem to be a valid means, however, of comparing the relative value of the two kinds of keyboards for touch typewriting. Touch typewriting requires that the student does not watch his fingers or keys. If the students with lettered keys require much more attention on the part of the teacher in order to acquire



touch typewriting, than those using blank keys, it would certainly show an advantage in favor of the blank keys. It would hardly seem necessary to have more proof to establish the superiority of machines with the blank keys.

It is rather difficult to decide which of the last mentioned bases is the better. To dispose of much argument, we could, without much trouble, obtain the data for both. If one is just as valid as the other, the results ought to confirm each other, and we would have the more reason to believe that we had used a valid procedure.

It is suggested, therefore, that wherever the experiment is tried, a record be kept both as to the teacher's efforts to produce touch typists, and, also, the ability of the students to do touch typewriting in a ten-minute test.

During the tests, however, no one should be allowed to look at his keyboard. Anybody doing it disqualifies himself on the matter of his ability to do touch typewriting and his record counts against that of his section.

For the benefit of those who do not know the requirements of the touch system, it might be well to make a few statements at this point. By touch typewriting we do not mean that a student must never look at his fingers or the keyboard. There are times when a student must look. After he has had his fingers off the keys, for instance, when he has brought his carriage over to the beginning of a new line, a student must get his fingers properly placed on the keyboard before he can proceed. Beginners cannot be expected to place their fingers on the proper keys without looking where they place them. This is perfectly permissible. Any other like reason would also allow the students to look at their fingers a second or two. But that is quite a different thing from being obliged to look at the fingers in order to be able to strike the correct keys. A person experienced in touch typewriting can very easily tell whether the pupil is looking because of valid reasons or because he is not a touch operator.

#### b. Time.

For the purposes of the experiment it would not make any difference how often a class meets, as long as both sections have the same advantages. It could be twice a week, three times a week, or more.

A test should be given when the class completes its work on the small letters and is just about ready to proceed with the shift key. Another one could be given after they have had some practice with the shift key, unless it came too close to the regular monthly test; another should take place one month from the day the first instruction was given, and subse-

quent ones at regular monthly intervals thereafter, for whatever time the experiment continues.

The final date of the experiment cannot be definitely set. It will depend largely upon how long one section survives, and that is part of the answer for which we are experimenting. If one or two months show that one section is at great disadvantage, it would seem wise to discontinue that method at once.

The section that survives with the greatest number of touch operators would indicate the method that should be followed in our schools. There should be a considerable difference between the two sections in order to show any decided tendency. If one section had 29 survivors and the other had 28, we could not say that one keyboard was superior to the other. If one, however, produced 30 and the other 5, and all conditions were scrupulously met, it would point strongly in favor of the 30. If these are valid results, they should duplicate themselves approximately in similar experiments tried elsewhere.

If the results appear absolutely contrary to sound reasoning, we shall have to look for the trouble-making-factor; if they are in accord with sound reasoning, we can consider the results valid.

#### c. Periods.

Both sections should take the work during the same period of the day if possible, taking for granted that their schedule is the same every day. We insist that one teacher should have charge of both sections, and, therefore, there are only two possibilities of having both sections meet during the same period of the day. If the two sections met as one class, in a room where both blank and open keyboards were in use, it would be possible. Also, if the class met only twice a week—one section on Monday and Thursday at, let us say, the fourth period, and the other section on Tuesday and Friday at the 4th period.

If neither of the two arrangements just suggested are possible, then the next best thing would be to have the sections meet at such periods when they would be equally fatigued or equally prime. The work which precedes would have to determine that, as explained on p. 56 ff.

If any of this work is to be done during the cold weather, it would not be wise to hold the meeting of the class during the first period of any session, because those who come in late—just from the cold—would have stiff fingers and would not be able to do good work until their fingers were warmed up.

#### d. Subject-matter.

The subject-matter to be used would be the regular typewriting text book in use by the school.

Ten-minute tests on the International Typewriting Contest matter and rules should be given. In the first test, of course, before the pupil has learned the use of punctuation and capitals, he should not be required to use them in the test, and should be marked accordingly.

Of course, the touch typewriting method will be taught. There would be no purpose in trying this experiment with any other method, as the blank keyboards were introduced as an aid to touch typewriting. The blank keyboard does not claim any advantages for the sight operator.

There should be but one varying factor, namely, the keyboards. Otherwise everything should be uniform, instruction included.

e. Details of procedure.

(1) Copy of Instructions.

The instructions should state that there should be two sections, one with the open keyboard and the other with the blank keyboard. The two sections need not necessarily meet at different times. See p. 220, Section c.

The teacher should be cautioned to be very keenly on the watch for those who use their eyes improperly, that is, for those who look at the keyboard when they should not. All through the regular lesson practice period, she will have to keep close watch, and especially so when the tests take place.

(2) Time limits.

A definite date should be set for the beginning of the experiment. The first test given after the class is organized will be immediately before the shift key is used; another when the pupils have had sufficient time to become accustomed to the shift key; another, one month after beginning typewriting; and others thereafter at regular monthly periods. The final date of the experiment will depend on each separate class. See p. 110.

(3) Form, order, and methods of giving directions. The teacher need not tell the students anything about the experiment. The instruction for both sections will be exactly alike, and the work they do will be the same. The only difference is that there are some operating blank keyboards and others operating open keyboards. There might be many reasons for finding two kinds of keyboards in one school or in one room. This need arouse no suspicions. At West Chester blank keyboards are desired, but during the War it was necessary to take what machines could be obtained, and a year and a half after the Armistice was signed, they still must use some open keyboards because these machines were not blank

when sent, and the man who is to do the blanking, has not been able to find the time to come to West Chester to attend to the matter. On a previous occasion a long wait was necessary to get all the machines of the room blanked.

The teacher should urge each student to make the best individual record. Nothing need be said about sections at all. If the students suspect that the result of the test may take away the open keyboards, they may conspire to make that impossible, by purposely producing other results.

(4) Record of interruptions, temperature, weather, ventilation, missteps, etc., should be made. See p. 59 ff.

## 2. Form.

The balance of the outline applies uniformly to all the experiments and is fully covered on p. 62 ff.

## b. SHORTHAND.

On this subject the methods of procedure for six experiments will be developed:

1. The first one is an attempt to get information which will enable a teacher to know when she may expect the students of her class to have fixed in their minds any outlines that she had presented to the class, that is, how many presentations are necessary to fix an outline.
2. The second is an attempt to get a basis for judging the length of a lesson, to know how many new ideas can be presented in a lesson with a reasonable expectation of their being retained.
3. The third is an attempt to get data that will help in making up schedules, to know what is the best method of arranging classes—every day, every other day, or is every third day too infrequent to reasonably expect much progress—in other words, intervals of repetition.
4. The fourth is an attempt to predetermine those who will never make high-speed stenographers because of high personal coefficient.
5. The fifth is a question of forearm movement versus finger movement in stenography.
6. The sixth is an attempt to determine what drill would be most valuable to the shorthand student.

## b. SHORTHAND.

Experiment No. 1. The Number of Presentations Necessary to Fix an Outline.

## I. FORMULATION

## 1. Introduction.

## a. General Statement.

Many shorthand teachers have no doubt been frequently exasperated to find that after they have put a certain outline on the board time and time again, there are still some in the class who have not absorbed it. We all know full well that one presentation to a class is not sufficient. A few may remember it from one presentation, but the majority will not. Since we must expect to give more than one presentation, after how many may we feel that the idea should begin to take root with the greater part of the class?

One thing that will have to be considered in this is the time element—the interval of repetition—but that is a factor by itself. It would seem reasonable to say that we could not expect fewer presentations to do the work if the interval is greater than if the interval is very short. Therefore, our first task will be to find how many presentations we must make with a comparatively short interval, or practically no interval, and after we know that, it may guide us as a minimum number of presentations, to be used in determining the other factor, that of interval.

If we can succeed in getting an experiment that will be valid, then a teacher will not be wasting time by presenting the outline more times than necessary, and, on the other hand, she will not be doing inefficient work by not presenting it often enough to reasonably expect the students to get it. It will make for efficiency in our teaching, and give the teacher some objective basis for her method.

This involves psychology, of course, and some experiments may be applied to it, and inferences drawn from it. Some experiments should be conducted in the subject itself where the principles are to be applied, however. It may be an entirely analogous case and it may not be. The only way to be certain is to try it. Many unforeseen factors loom up in situations that had appeared to be identical but which later proved not to be so. If the fields are identical, nothing will have been lost, because the conclusion reached will confirm that of previous experiments, and help to make the result all the more certain of being soundly grounded. If the result

does not bear out the former conclusion, it will show that there was some element in the situation which had not been anticipated and therefore there is all the more reason for treating it as a separate case.

b. Survey of Experiments Made.

The investigation has disclosed no experiment in this field.

c. Differentiation.

Therefore, no differentiation is necessary.

2. Specific Statement.

This experiment is planned to help answer the question, "How many presentations are necessary to fix a shorthand outline?"

## II. SELECTION OF LABORATORY

1. Groups Chosen.

Beginners in the study of Shorthand should be chosen.

The number of presentations necessary to fix an outline, of course, will depend upon the number of associations a student can make to retain the outline. It will depend upon his apperception or the manysidedness of his knowledge, and of his ability to apply that manysidedness. When one reaches the point where he might make many connections and thus help himself to fix an idea, another factor may enter into the experiment—the ability or desire to make the connection, the influence of which factor it would be difficult to determine. In other words, let us say that we are presenting an idea which can be hitched up to a great many ideas in the possession of all the students. Some of them will make all the connections and therefore get the idea firmly fixed, while others, through inattention or lack of desire to exercise the necessary mental concentration, will not make the connections, and, therefore, will not get the idea so well fixed. It would be difficult to determine whether the number of presentations is the element responsible for not getting the work, or mental laziness.

This, then, is a factor to be avoided if possible. It can be greatly eliminated by choosing for experimentation elementary things in a subject, which things as yet do not have many connections in the mind of the student. In Shorthand it would, therefore, seem best to experiment on be-

ginners' classes and to experiment on the alphabet, which takes them at a point where the whole subject-matter is new to them and where there are very few connections with what is already in their minds, and where they must get it from the presentation of the teacher. If an advanced class is taken, it seems to the writer that the results would not be just as valid for laying down a general principle, because the element of interconnections would enter, as mentioned above. It would, nevertheless, be interesting to have some experiments made on advanced students to see just how much our supposition regarding them is warranted and how the results compare with those obtained from the beginners.

The present experiment is planned for beginners in the subject of Shorthand.

## 2. Schools Chosen.

### a. General Character of Student Body.

The experiment should be tried in as many schools as it is possible to get to undertake the matter, and it should be undertaken with the Pitmanic systems as well as the Gregg and others.

The object of this experiment, as of some of the others, will be, not to ascertain what is the result with an ideal class under ideal conditions. That will be a development of the years to come, but the object of this experiment will be to ascertain how many times do we find it necessary to present ideas to the students at present in our schools, taking them just as they are—bright, dull, mediocre, etc.—and under normal school conditions existing today, with good teachers, poor teachers, and medium teachers. We shall then at least be able to say that a certain class gets it or does not get it, after having had the number of presentations required by the average for the schools tested; or if we find that the average will not give us a correct understanding of what is needed, we can use whatever other figure seems best. This would be a decided step in advance of present conditions. From this we could work out the matter more ideally.

Therefore, the experiment could be tried in any school and with any student body. It would be of value if some details were given in the report, as to the character of the school and student body, whether the shorthand work is considered first class or not, and whether the students come from the better families of the community or from the foreign element. Some of these remarks, of course, will only be opinions, and will be regarded as such, but they might throw some light on variations.

### b. Accessibility.

The school should be accessible to the experimenter as mentioned on p. 36 ff.

c. Co-operation.

There should be co-operation on the part of everyone, as explained on p. 38 ff.

3. Teachers Chosen.

Because of the complex method involved, it will be necessary to obtain, for the experiment, teachers of more than ordinary intelligence. It would be better for the experimenter to conduct the work himself, but, if this is impossible, the next best thing would be to have a good teacher do it, being sure that the instructions are written out fully for her and in such a way that she understands them.

The teacher should meet the conditions specified on p. 41 ff.

### III. CHOICE OF CONDUCTOR

It would be well, if possible, for the experimenter to do the work himself. The subject-matter is new to the students, they have not become accustomed to any teacher in that subject, and therefore no disturbing element would enter by having anyone else than the regular teacher take charge.

The teacher herself could undertake it if she is fully conversant with the instructions.

What has been said on p. 44 ff. regarding choice of conductor also applies here.

### IV. DEVELOPMENT OF A PROCEDURE

1. Content.

a. Difficulties.

(1) Tests.

There will be no need for preliminary tests, as we are going to take things as we find them. It would help in reconciling variations, however, if the report contained some information about the students, such as the age, to which class in high school they belong, whether they are taking



the two year or four year commercial course, whether the room in which the instruction was given is so arranged that all the students could well see the work on the board, whether they are a high, medium, or low type of student, generally speaking, etc. The time between presentations might be noted.

See p. 118, under Details of Procedure, for final tests.

(2) If the investigator is going to do this work himself, of course, there will be no need of conferences with teachers, but unless he does that, he should have conferences with the teachers to explain just what is to be done, and to state clearly that the essential thing is to make only the number of presentations called for and to make them properly. A carefully planned, written set of instructions should be handed to the teachers for them to study in advance of the time for the experiment.

(3) Other Difficulties.

The essential feature will be testing the student after each presentation, to see whether or not that presentation has fixed the idea. It will differ from Experiment No. 2 under Shorthand, in that only one idea will be presented at a time in the present experiment and then tested for. The object of this experiment is not to see how many ideas can be presented at one time and how many repetitions are necessary. There are two factors in such a question, as will readily be seen. This experiment merely tries to determine how many times an idea must be presented by itself in order to stick, and its practical application comes when in the midst of a lesson a student will ask, "How do you write such and such a word?" That is a single idea at a time. How many times is it reasonable to answer that question for that class? That is the purpose of this experiment. The one chief difficulty will be that there will be considerable marking of papers and the method will likely interfere with the teacher's regular way of presenting the alphabet to the class, and it may delay the class somewhat in its scheduled progress. But it is worth while if scientific data can be obtained thereby.

#### b. Time.

The experiment should be conducted during the regular shorthand period and the number of letters presented will be limited by the length of the period. That will have to be adjusted in each case, and a record kept of it. At the beginning of each period there should be a test on the work of the previous period to see how much has really been retained. (If the teacher could take the time to glance at these papers before proceeding with the work of the class, they might cast light on some flaws that ob-

tained in the last recitation.) The experiment will necessarily be conducted at the beginning of the study of shorthand, whenever that takes place.

c. Periods.

The time of day will be the regular shorthand period. Of course, the efficiency of the work will depend greatly upon what preceded. A note should be made of the lessons that preceded, so that this data may be taken into account when considering the results. Ideal conditions, of course, would likely give a different result but we now wish to ascertain how many times, under existing conditions, it is necessary to present an idea in order to fix it. With this as a guide, we will then be better able to proceed with the experiment to help determine how many ideas can be presented at one time.

d. Subject-matter.

The subject-matter to be used for the experiment will be the shorthand alphabet, no matter what system is being taught. The object is to give the students the most elementary things—things for which they have up to this time the least number of mental connections to which to hitch them. In the Pitmanic systems, the consonants will be taken first and then the vowels, although there is no particular reason against reversing the order, or mixing the consonants and vowels. We may find that we shall be obliged to reach one decision for the consonants and another for the vowels, in the Pitman systems, because of the difference in the nature of the marks for these letters.

e. Detail of Procedure.

(1) Following is a detail of the procedure which should be handed to the teachers in charge of the classes:

The object of this experiment is to ascertain how many times it is necessary to present an idea to a regular class (that is, not an ideal class, but a class as we find it in our school) before the majority of the class get it in such a way that it becomes fixed.

The experiment will be conducted with the beginners in shorthand and it will cover only the period taken by the class for the alphabet. No text books should be handed to the class for the reason that if they are, the students can, before the next lesson, look at the page giving the alphabet

and have some presentations which will not be recorded and the results, therefore, will be made invalid.

Those teaching any of the Pitmanic systems will present 8 of the consonants at a lesson, and then six vowels, in the following order, let us say:

p, t, ch, k, b, d, j, g,  
f, th, s, sh, v, dh, z, zh,  
m, n, mb, ng, l, r, y, w,  
the three light dots and three heavy dots,  
the three light dashes and three heavy dashes,  
the diphthongs.

It will be found that the matter of getting papers ready and arranged takes up considerable time. One thing that must be borne in mind is that we cannot give the students any opportunity to get even an unrecorded glance at a letter. This must carefully be taken into consideration.

Therefore, the papers must either be collected after each presentation and test or else the papers must be so arranged that they can be folded, thus making it impossible for the student to see what he has already written.

The following method was tried in the West Chester High School:

The class was given the regular pages torn from shorthand note books, which had been cut crosswise in this fashion:

|            |
|------------|
| Name, Date |
|            |
|            |
|            |
|            |

They were not cut quite to the end, so that it would be easier to pass the papers out, and so that the student could put his name on them. After the papers were distributed, the student was asked to write his name and date on each of the slips, and also to number them consecutively. After the first presentation was made the students were asked to write the letters on the top slip. This was torn off, turned face downward at once and collected. The letters were presented again, the test given (the second slip being used for that), the slip torn off, turned face down and collected, and so on. This made it absolutely certain that the student did not see his former paper, but it wasted time.

The following method is better and could be used without any fear of invalidating the results, providing the teacher will see that the students do

as they are told. It would save much time. The regular note book sheets could be used. Have each student write his name and date at the top. Present the letters. Then ask the student to write them. After they have done this, instruct them to fold the paper, making two folds at the top so as to be sure they cannot look at what has been written. In telling them to fold, it will be necessary to say definitely how many inches. It should be  $\frac{1}{2}$  inch, at least, for each fold. Then give another presentation and another test and have them fold over the paper in the same manner. Another advantage of this method would be that all the work of one student would be on the same sheet of paper and comparison of individual work could be made more easily. Of course, in the case of the slips torn off, they could be pasted together again and in that way the work of each student would be assembled. But the loss of time in collecting papers is the objection to the separate slip method.

If the separate slip method is used, time could be saved by having the sheets numbered in series, having the student put his name only on the first. The only time lost then would be in collecting and, if the teacher is a good manager, that might be done quickly.

It is suggested that the first lesson be conducted as the particular teacher would do it under ordinary circumstances. After whatever introduction she saw fit to give, she might proceed somewhat as follows:

"The system we shall learn is called the Benn Pitman (or whatever it may be) system, after Benn Pitman, the man who developed it. When you started writing longhand, down in the early grades, the first thing you had to do was to learn how to write the letters of the alphabet. That is exactly what we must do. You will remember that there are two kinds of letters, consonants and vowels. We shall learn the consonants first.

"Now, the Benn Pitman system belongs to those systems which are called geometrical systems because they are made up of straight lines and curved lines, for instance, taking a circle, we cut it thus (cut it into quadrants, using vertical and horizontal diameters) and another thus (cut it into quadrants, using oblique diameters). Now I shall give you some of the letters. I shall give you eight today. The first one is this straight line." Point to it in the cut circle. Then write it separately on the board where all can see, making it large, and saying, "This represents the sound of the letter 'p,' and is called 'pu' (or 'pee', whichever method is in use in the school in question)." Then pause a little while for that to make its impression, but do not repeat.

"The next is this line, (t)." Point to it in the circle and make it on the board, saying, as you make it, "It represents the sound of the letter 't' and is called 'tu' ". Say this very forcefully and deliberately, so as to give

it the greatest possible chance of penetrating. In this way proceed with the rest of the first eight straight lines. Be sure to show the connection between the heavy and light sounds and the heavy and light marks. When you have finished the last one, just calmly erase all that you have put on the board. Then ask the students to take their papers and pencils and write down as many of the letters you name as they can remember. Then call them off to the students, distinctly and slowly enough for the students to get them, repeating only when the letter has not been heard. Then have the papers torn off and placed face down on the desk and have them collected. Or if the second method is used, have the students fold down the paper twice. Then proceed with the same eight letters again, putting each shorthand character on the board, telling what sound it represents and giving its name; then erase the characters quickly and have the students write them from dictation. It might be advisable to give the first set in the order in which they were presented, but each of the other sets should be given in a different order. For the second test the following order is suggested: ch, k, d, p, j, b, g, t. Collect the papers or fold them over, and proceed again as before. Do this as many times as the period will permit. Stop long enough before the end of the period to assign homework for the next time.

The papers should be marked, and record made as follows:

LETTERS WHICH EACH STUDENT FAILED

|            | 1st<br>presen-<br>tation | 2nd<br>presen-<br>tation | 3rd<br>presen-<br>tation | 4th<br>presen-<br>tation | 5th<br>presen-<br>tation |  |
|------------|--------------------------|--------------------------|--------------------------|--------------------------|--------------------------|--|
| John Smith | — \ /                    | — \ /                    | — /                      | — /                      | — /                      |  |
| Geo. Green | — —                      | —                        | o                        | o                        | o                        |  |
| Wm. Jones  | / — / —                  | / — / —                  | — / —                    | / —                      | —                        |  |
|            | 6th<br>pres.             | 7th<br>pres.             | 8th<br>pres.             | 9th<br>pres.             | 10th<br>pres.            | Presenta-<br>tions neces-<br>sary before<br>student got<br>all perfect |
| John Smith | /                        | 0                        | 0                        | 0                        | 0                        | 7  |
| Geo. Green | 0                        | 0                        | 0                        | 0                        | 0                        | 3  |
| Wm. Jones  | 0                        | 0                        | 0                        | 0                        | 0                        | 5  |
|            |                          |                          |                          |                          |                          | <hr/> 3)15<br>5  |

This record will show the teacher first, where the weakness of each student is, and which letters need most emphasis. It may reveal something about the order of presentation. It may show that the last letters presented are the ones which it takes longest to straighten out. It may show

that the student at the third test got a certain letter correct but failed on it in the 4th test, etc., which, of course, calls for an explanation. The final column should then be added and the average found. That would then show how many times it had to be presented before the majority of the class fixed the idea.

(2) Time Limits.

Date for beginning experiment should be definitely given. The final date will depend on the number of letters in the alphabet of the system being taught.

(3) Form, Order and Method.

The paper having been given out, and the names of the students and the date having been written thereon, the teacher can proceed with the lesson as described under Detail of Procedure, p. 118.

(4) Record of Interruptions, etc.

Careful record should be made of any interruptions, mis-steps, etc., as mentioned on p. 59 ff.

2. Form.

The balance of the outline is uniform for the experiments and is fully covered in p. 62 ff.

b. SHORTHAND.

Experiment No. 2. The Number of Ideas That Can be Presented in a Lesson.

I. FORMULATION

1. Introduction.

a. General Statement.

This experiment somewhat involves the preceding one.

The whole matter of preparing a lesson involves the questions of how much should be given and how often it must be gone over. No doubt, the one has bearing on the other. If we give the student too much, we shall have to go over the work often, and if we give him only a very small quantity, we may not have to go over it often at all. We must, however, try to find how each of these stands alone, for it may enable us the better to understand the combination. This experiment tries to dwell particularly on one feature—quantity.

We are reaching the time when efficiency will play a much larger part in our teaching than it does today. To be efficient, we must know just how much to expect from the students and require all of that from them. Our commercial teaching should be in such shape that we can be most efficient in it. More things are crowding into the commercial curriculum, and, if all these things must be done in four years of high school, we must do them in the most economical way.

In Beginners' Shorthand, are we going to give the students so few ideas at a time that they will absolutely master them very easily? If so, it will take considerable time to cover certain ground, and possibly some of the class will lose interest in the subject because it presents no problem to the active mind. Or, shall we overload the students with so many ideas that they cannot begin to master them, which will in the end mean lost time? Or, are we going to give the students just enough so that all can be mastered and quick progress can be made at the same time?

To be sure, we are dealing with the individual student in each case, and the teacher must, in the last resort, decide how each of the students she has before her is capable of taking a lesson and then base her assignment upon that judgment. But suppose she decides that most of her class are very bright, how many ideas will she give them in a lesson? She has nothing objective to use as a standard, unless she has done some experimenting along this line herself. She merely guesses at it. She may get the number too large or too small, in either case the efficiency is not the highest. We ask her why she gives a certain amount and she answers, "That is what John Smith gives." He may be a man of good judgment, but many people may disagree with the statement that he is a man of good judgment, and for them his opinion will not count for anything. She may say, "They do it that way in a certain high school." But unless that high school has looked into the matter scientifically, that mere statement does not produce any scientific data. Consequently most of the teachers are at sea. By having the results of some scientific investigation before her, this teacher can, at least, reason in this way: "The average student in the schools tested is progressing with so much of an assignment. Most of the schools in this list are of a reputation that is below our school. There are no cases noted of classes of very bright students. My students are very bright. They should be able to do, at least, what the average student in these other schools does. I shall try them on this first. If this works well, I can increase their assignment each day, till I find the maximum amount they can do."

This teacher then would have some actual point from which to start, which she does not have at present. Teachers who have tried out this

objective scale can then report, or, rather, will soon be interested enough to express opinions, as to whether the matter is working out satisfactorily or not. If not, then more work will have to be put on it, until the scale does prove satisfactory.

A method is required in this experiment which will give presentations of an increasing number of ideas, with tests to check up how the ideas become fixed. We need not start at one, then take two, and so on. It is safe to assume, *a priori*, that everyone with mental equipment can absorb one idea in a lesson, if it is clearly presented. The same can be said of two ideas. Yet we cannot say that everyone could absorb 50 ideas in a lesson. Somewhere between these extremes is the point where most of our present-day students reach their limit. To find that, if we can, is our problem.

Again, as before, we shall try to ascertain what the situation is in our schools as we actually find it today. We are not so much concerned with what might be done by an ideal class under ideal conditions. We do not have these classes in our schools and while it is a good thing to know what to expect under ideal conditions, it would seem to be of much more value to us to know what to expect under present conditions.

There should be a pre-preliminary test on this, so as to be able to find the lower and upper limits, so that the test itself may be undertaken without the loss of unnecessary experimentation.

#### b. Survey of Experiments Made.

No experiments have been found that take up the matter of presentations in shorthand, although the psychological laboratories have undertaken experiments on presentations in general.

#### 2. Specific Statement.

This experiment is undertaken to try to determine the number of ideas that can be presented in a shorthand lesson.

## II. SELECTION OF LABORATORY

#### 1. Groups Chosen.

So far as the pupils selected for the experiment are concerned, it is simply necessary to say that they should be beginners in the subject of shorthand. There is likely to be a difference in the work of the older ones and



the younger ones. Therefore, the record should contain the age of the pupil, and his class.

## 2. Schools Chosen.

The experiment should be conducted in as many schools as possible. The wider the range, the better the result would be. It should be undertaken with the Pitmanic systems as well as the Gregg and others.

What is said in the previous experiment on p. 115 ff. also applies here.

### b. Accessibility.

The school should be accessible to the experimenter, as stated on p. 36 ff.

### c. Co-operation.

There should be co-operation on the part of everyone, as explained on p. 38 ff.

## 3. Teachers Chosen.

The same conditions hold as in the preceding experiment. See p. 41 ff.

## III. CHOICE OF CONDUCTOR

It would be best, if possible, for the experimenter to do the work himself. What has been said regarding the matter in the preceding experiment, p. 116, also applies here.

## IV. DEVELOPMENT OF A PROCEDURE

### 1. Content.

#### General Plan.

The plan to be followed in this experiment would seem to require giving the students a certain number of ideas that they have not had before. The shorthand alphabet would answer the purpose nicely. If it is found that the students readily learn the number that has been given, it should be increased.

## a. Difficulties.

## Pre-preliminary Tests.

Before the experimenter can proceed, it will be necessary for him to ascertain roughly, at least, the minimum number of letters that can be presented in one lesson. He may have to decide that arbitrarily. All would agree that one is too small a number. All would also agree on two, but somewhere along the line a disagreement would take place. Therefore, some pre-preliminary tests will be necessary to determine the minimum number of ideas to be presented—in this case, the minimum number of letters.

The following is suggested for this pre-preliminary test, and the experimenter should conduct this himself.

The work should be tried on a beginners' class in shorthand.

Some number must arbitrarily be decided upon, as the number of letters to use in the lesson, after which that number must be tried out to see whether or not it works. Let us take 8 letters. Any eight would do. A Pitman teacher might take the 8 straight stems.

We shall follow the same procedure as in the last experiment, that is: present the letters to the class in the way shown and then ask the students to reproduce the characters from dictation. This process is to be continued as long as the period lasts. These results could also be compared to advantage with the results from the previous experiment. The papers should be recorded on a schedule similar to the one used in the last experiment.

Not much could be told by this one performance. However, it would tell by the number of presentations necessary before the majority of the class fixed the ideas, whether eight letters are too few or too many.

At the next lesson, the experimenter should give the class a test on what was given them the last time. Just one test is to be given, to see how they have retained over the extended period. Then he may proceed with the experiment itself.

Let us say that eight was found to be too small a number, that most of the class had mastered these in a small number of presentations and after that were writing them correctly. This being the case, we might find that 10 did not make much difference, and, since the number of characters in our alphabet is limited, we must make good use of them. Therefore, it is suggested that we try 12 the next time. After 12 have been presented, the papers should again be marked and record made as in the former lesson.

Now we can begin to make some comparisons. Did the majority of

the class write the 12 characters correctly after the early presentations? If so, then we must conclude, it would seem, that 12 is too small a number. Possibly then, the next lesson should deal with 15 or 16. Let us say that the majority of the class retained the 8 letters in six presentations, and the majority of the class retained the 12 letters in 12 presentations. We would then know that 12 is entirely too large a number to give at one time and the next lesson would better be confined to 10.

Furthermore, we should consider which letters caused the trouble. Were they among the first six presented or among the last six? Could they be confined to the last four or the last two? If there is a consistent failure on the last two letters, could we assume that 12 was too large a number and that 10 would more nearly come within the ability of the students? Or do we find that the letters that were not learned well are mixed and do not seem to follow any particular order. Do our findings bear out the findings of the psychological laboratory with respect to retention?

However, the next test should be made with 10 letters, presented in the same way as in the former ones. The papers should be marked and the record kept just as in the other case. We desire to know whether the gain has been any greater than with the 12, or just as great as with 8. Then we would say that 10 is the proper number to present in this kind of shorthand lesson.

Now then, let us say that the experimenter is going to try this on a large scale, so large that individualities need not be considered. Then it would be well for him to give one set of experiments in certain schools, using 10 letters a lesson in each of the experiments, until the complete alphabet is used. Another year, or with another set of schools, he could try 8 letters a lesson; with another set, or another year, 12 letters. In the last case, the teachers would have to be on the lookout and not let this interfere with the efficiency of their teaching. It would only affect three lessons, however, and the damage done in three lessons, if 12 letters were beyond the reach of the students, could easily be remedied.

These results should be graphed by the experimenter and they would show valuable information. On a large scale like this, even though the 8, 10 and 12 were not tried on the same pupils, the results would be valid because individualities have been balanced by large numbers. The difficulty is that after the student has once learned the alphabet, we cannot try any other number with him, and it is therefore necessary to try the experiment on an altogether different set of students.

In this experiment we should keep all other factors alike, except the number of letters presented. That is the factor for which we are testing.

(2) Preliminary conferences may be necessary in order to get the

matter clearly before the teachers. It might be, however, that written instructions would suffice. It would depend largely on how clearly they can be written up.

b. Time.

The experiment should start when the subject of shorthand is begun. In order that the interval of repetition may not be a large factor, the lessons should be given on succeeding days. Since the alphabet is small, it would not take much time to complete the experiment at the rate of 8 or more letters given each day.

c. Periods.

The work should take place during a period when the students are not fatigued, upset, or otherwise incapable of serious work. The report should state what preceded, at least, for the session, and should state at what period the work was done. See p. 56 ff.

d. Subject-matter.

The subject-matter will be the alphabet of the shorthand system taught in the school where the experiment is made. Sign-words are not such good material because there are more interconnections for them than there are for the letters of the alphabet, and we could not control that factor, as some students make good use of interconnections and others do not.

It may be that the results will be different in the various systems of shorthand.

e. Details of Procedure.

(1) The copies of instructions should clearly state the method of the instruction and tests. Similar precautions are to be given as in the case of the preceding experiment.

(2) Time Limits.

The time limits should be stated definitely. The length of the experiment will depend on the shorthand system taught, which would condition the number of characters to be presented.

(3) There are no special instructions regarding form, order and method. See p. 58 ff.

(4) Interruptions of any kind might be a very disturbing factor and should be carefully noted, as mentioned on p. 59 ff.

2. Form.

The balance of the outline applies uniformly to all experiments and is covered fully on p. 62 ff.

## b. SHORTHAND.

### Experiment No. 3. The Proportion of Time Spent in Reading Back Shorthand Notes in Class.

#### I. FORMULATION

##### 1. Introduction.

##### a. General Statement.

In the statement of this problem we come to another of the practical questions that confront the teacher of shorthand. Shall we have the students read back to us (and that is the only way of being sure they do read it back) all the shorthand that is dictated? It would be a good thing if we had the time, but reading back is such slow work with some students and it would not leave very much time for the dictation itself. Of course, the students could be told to read back their day's dictation as homework, but conscientious work along that line is an impossible thing to check up and so we must dismiss that idea at once. There is a real problem here for the teacher of shorthand. The students must be able to read their notes quickly. Without practice they will not be able to do this and the teaching is a failure.

Time does not permit having them read back all of their notes in class and still receive a considerable quantity of dictation. If we give it to them for homework, we are not sure that they are doing it, and we have a problem that we must try to work out.

Information regarding the practice of other teachers in this regard was desired and therefore a questionnaire was sent to a list of high school teachers of the country. The question read as follows: "What proportion of the time do you think students should spend on reading back their notes, i. e., do you have the students read back all their notes? Do you use half the period reading back, or what method do you have?"

The following information has been tabulated from the answers received:

|   |   |
|---|---|
| Schools requiring that all the notes be read back | 8 |
| Schools that read back practically everything...  | 7 |
| Various methods used .....                        | 1 |
| Read back as much as possible.....                | 3 |

|  |   |
|--|---|
| Read and re-read .....                           | 1 |
| Schools using 1-3 of period reading back notes.. | 3 |
| Schools using $\frac{1}{2}$ of period.....       | 4 |
| Schools using $\frac{1}{4}$ of period.....       | 1 |

Considerable difference of opinion exists, as will be noted.

b. Survey of Experiments made.

The search has revealed no experiments made along this line.

2. Specific Statement.

This experiment is undertaken with the purpose of trying to decide what proportion of the time in class should be spent in reading back shorthand notes.

## II. SELECTION OF LABORATORY

1. Groups Chosen.

The pupils on whom this experiment is to be tried should be advanced students in shorthand—students who are taking dictation.

Two sections of each group will be needed, and some equalization test will have to be found for determining the sections.

We desire to ascertain what procedure we should follow with classes as we find them today, and therefore, we shall not exclude any students except such as necessary in order to equalize the sections.

2. Schools Chosen.

a. General Character of Student-body.

In this experiment we would like records from as many schools and as many different types of schools as possible. A statement should accompany the report of each school, giving some information regarding the type of students tested.

b. Accessibility.

The schools should be accessible to the experimenter as explained on p. 36 ff.

c. Co-operation.

The necessary co-operation of all concerned should exist as explained on p. 38 ff.

### 3. Teachers Chosen.

The teachers chosen should be sufficiently intelligent to undertake the work and should have the proper attitude of mind, as explained on p. 41 ff.

## III. CHOICE OF CONDUCTOR

1. The regular teacher would seem to be the one best suited to take charge of the class. The students are accustomed to her and would not be disturbed as they would be by bringing in an outsider for the work.

One teacher, however, should have charge of both sections, to avoid variation in personality.

See p. 44 ff. regarding choice of conductor.

## IV. DEVELOPMENT OF A PROCEDURE

### 1. Content.

#### a. Difficulties.

##### (1) Pre-preliminary tests.

Our difficulties seem to be these:

If we devote less time to dictation, it will be more difficult to acquire the speed necessary for the students. If we devote more time to reading, they should be able to read more rapidly.

And vice versa.

We have two varying factors in the consideration. We must make one of them constant and permit the other to vary.

It would seem logical to make the dictation factor constant and let the reading factor vary. But how can we accomplish this?

If we had a norm or scale in shorthand, showing the amount of speed that should be gained each month, etc., it would solve our problem quickly. In the absence of such a scale it will become necessary to arbitrarily set a certain number of words of dictation per minute, as the increase in the writing ability of the students for say one month. The dictation given to both sections is to have that objective in mind. The dictation should be given at the same rate to both sections. One section, however, devotes

more time to reading back than the other, which means, of course, that it devotes less time to taking dictation. The test at the end of the month is to ascertain which section can best read its notes, taken at the required speed for that month.

To find out which section can best "read its notes" we could use either of the two methods following:

The most accurate but least practical method (because it takes too much time of the teacher) would be to have the students read back their notes privately to the teacher, the teacher having stop watch in hand and noting the time required to do the reading.

A less accurate method would be to have the students transcribe their notes on the typewriter. This would not be purely a reading test. It would also involve a person's ability to typewrite quickly. If this method is used, the result would have to be expressed in a ratio representing the person's speed on the typewriter while transcribing his notes. His speed in copying from a printed page will usually be considerably greater than his ability to copy shorthand notes—at least it would be so with advanced students. It is his inability to read his notes more quickly that hinders him from attaining the same speed in transcription as in copying printed matter. Three 10-minute speed tests from copy matter, using International Typewriting Contest Rules, ought to give a fair idea of the student's absolute speed on the machine. (See Typewriting Experiment No. 1, page 71, for further details on conducting such tests.) Three letters of say 100 words each, taken at the designated speed for the month, and transcribed just as fast as the student can do so, ought to give a fair idea of his transcription speed. The average of the three in each of these cases, should be taken. In the transcription tests we should not count typographical nor mere spelling errors (except where the spelling indicates that the student did not read aright) and the student should be so told. If we divest the tests of all these things, we will more nearly approach the student's real reading ability.

There should be an EQUALIZATION TEST at the beginning of the experiment, based on reading ability at a given speed in dictation. The sections should be formed on the results of this test.

If the students are to read back their notes orally to the teacher in private, she will take the time required by means of a stop watch and note the speed of reading each of the three letters. The average we shall call the student's reading speed, and from this we shall make up the sections. The dictation would all have to be given at one time, and the students would be required to put their notes out of sight until their turn came. How disturbing an element the wait would be for the last ones called up,



is hard to tell. A pre-preliminary test along that line should shed some light on that point. The waiting-period would be shortened if several teachers could hear the reading.

If the students are to transcribe their notes, we shall have to form the sections on the basis of the ratio of the transcription speed to their copying speed.

It would prove interesting to ascertain whether the sections would be made up just the same, no matter which method were used. A pre-liminary test should be conducted to determine this.

The FINAL TESTS, given at the end of the prescribed time, would have to be taken in the same way, and scored accordingly. In the case of the transcription basis, the average speed in copying printed matter should again be obtained, and this figure used in the ratio. The student has had time to increase his absolute speed and the ratio would not be correct if the equalization test speed were taken.

In the case of the oral reading, we would have to get some sort of marking basis for judging. Possibly the easiest way would be to use the number of words read per minute minus a certain penalty for each word incorrectly read. In typewriting, according to the International Typewriting Contest Rules, 10 points are deducted for each word wrongly written. Would 10 be too great a deduction for each word incorrectly read, the basis being the reading of 100 words? Correctness is an essential in the reading, and possibly we cannot penalize too heavily for it because of its importance.

To illustrate, the proposition would work out in this way on the above basis. John Jones is in the A section. The A section is taking dictation for half the time and reading back half the time. In the equalization test John Jones receives 90, let us suppose (he read orally to the teacher at the rate of 100 words per minute but made one mistake, for which we have penalized him 10 points). In the final test John Jones makes 120. (He read back at the rate of 120 words per minute with no errors). William Smith is in the B section. The B section is taking dictation for three quarters of the time and reading back for one quarter of the time. In the Equalization test William Smith gets 90, let us say, reading at the rate of 100 words per minute with one word wrong, a penalty of 10, leaving 90. John Jones and William Smith were on the same basis at the start. In the final test, however, William Smith gets 80, let us say, for an average, 100 words and 2 errors, making a penalty of 20. As the matter stands John Jones now gets 120 and William Smith 80, whereas they were both at the same starting point. Would it be a valid assumption to say that the one section, the B section, is not getting enough reading practice,

if the records of the rest of the class ran in about the same way? It would seem so.

To illustrate the other basis of forming the sections: We find that the average of Jack Green for his three speed tests in copying from printed matter, is 40 gross words per minute. We find that his average for transcribing three 100-word letters is 20 words per minute, allowance having been made for all errors which are not strictly reading errors, and a penalty of 10 being imposed for each error that is a reading error. We shall say that his beginning speed is 20:40 (or 20/40). Jack Green is put into the A section. Dan Wilson, who has the same average, 20:40, is put into the B section to balance matters. The A section reads half the time and takes dictation the other half. Jack Green's final average is 30:42. The B section takes dictation three quarters of the time and reads back the other quarter. Dan Wilson's average for the final is 19:43. These records are typical of the respective sections, let us say. Are we justified in saying that the half and half distribution of time is better than the one quarter and three quarters?

Before this experiment is tried on a large scale, a number of pre-preliminary tests should be made to try out the several factors that enter into it.

In the first place, we ought to try out the division of the periods, that is, half and half, three quarters and one quarter, and any other combinations that we may think appropriate. There may be a number of reasons why any one of these cannot be worked from the practical standpoint. Certain combinations would require the re-reading of certain notes too often, as for instance where the dictation period is short and the reading period long. Memorization may take place and no reading, after the first time a letter is read back. On the other hand, it might be found that with some classes, if things were reversed, too much time would be given for dictation and not enough for reading, to cover any ground worth mentioning. Classes differ so much in their make-up and ability that some surprises may be presented to us. After we have found a division of time that works, it could be used as the basis for the experiment on a large scale.

The viewpoint is being taken that if measured by time, the experiment would be easier and more accurate and practical than if we measured the amount of work done, which would often be very difficult and might not be very accurate.

It would seem better to plan the experiment upon a time basis rather than a quantity basis, for it would be far easier to keep account of one than the other, and it would lessen the opportunity for another varying element to creep in.

Another pre-preliminary test should be made to determine whether or not we can actually make an equalization of sections on the ratio basis, such as 20:40, etc.

There should be no trouble in obtaining the oral reading speed of a student. It has often been done and some teachers in fact, take that into consideration when making up the shorthand mark for the month.

A pre-preliminary experiment ought to be made before trying it on a large scale, because there are several elements in it that seem sound in theory but which might be badly upset by actual trial. Some that have seemed more sound than these, have been upset and consequently even many of the simplest operations should actually be tried out.

(2) Preliminary conferences. While the procedure of this experiment is rather large in detail, nevertheless it is not exceedingly complicated. A teacher of ordinary intelligence should be able to handle it from written instructions. If it is found, however, that this does not work, the experimenter will have to resort to personal conferences with those concerned.

See also p. 51 ff regarding this.

#### b. Time.

This experiment could be conducted during any time of the year when the advanced stenographic students are available. It is not the intention to upset school schedules, and therefore, the classes would meet on the regular days for the subject. In most schools advanced students in shorthand take the subject every day.

A decision will have to be made as to whether the experiment is to continue one month or longer.

Dates for equalization and final tests will have to be set.

#### c. Periods.

The sections would most likely meet at their regular periods. It will be necessary to change the schedule to make it possible for the one teacher to have both sections.

A record should be made as to the programme of the students for the preceding part of the session, at least, as a help in trying to account for differences. See also p. 56 ff.

#### d. Subject-matter.

The subject-matter would be the regular shorthand dictation work of

the class. For the typewriting speed tests from copy matter, any of the material used for the International Typewriting Contests, would do. The same matter should be used in all three final tests. The letters dictated for transcription or oral reading should be ordinary business letters, or about the same degree of difficulty and should be devoid of technical terms. The identical letters should be used in both sections, in the tests, and also in practice work, as far as possible. (It will not be absolutely possible in practice work because one section gets more dictation than the other, unless we confine ourselves to certain letters, and require the one section to use up their surplus time in going over those as often as necessary to use up the time.)

e. Details of Procedure.

(1) The instructions should be written out very carefully, so that the assistants may have no difficulty in understanding the matter. Students should be instructed that there is to be no reading of shorthand notes outside of class.

(2) The instructions should state when the experiment will begin and end, and when the tests are to be given.

(3) No particular form, order, or method of giving directions to the students is necessary.

(4) An accurate record is to be kept of all interruptions, etc., as explained on p. 59 ff.

2. Form.

The balance of the outline applies uniformly to all experiments and is covered fully on p. 62 ff.

b. SHORTHAND.

Experiment No. 4. Intervals of Repetition.

1. FORMULATION

1. Introduction.

a. General Statement.

Another practical question that concerns shorthand teachers, especially those who have anything to do with the arranging of a schedule, is the

following: "How often should the various classes meet in order to produce the best results?"

Psychology tells us that an idea will remain with us for a certain time. Before the expiration of that period it can be recalled but after the expiration of that period, recall no longer is possible and then it requires re-learning. What is the period for shorthand as it is now taught?

We have this situation: Possibly the majority of the teachers believe it would be best if we could have shorthand every day. But that is impossible in many schools for various reasons. Then a choice must be made between twice or three times a week for the subject. Are we agreed to say that three times a week means just three-fifths of the efficiency that could be secured from five times a week? Or that twice a week means two-fifths of the efficiency? It would be interesting, if not instructive, to have some data on this. The present experiment tries to present a method for obtaining information on the relative merits of these methods.

#### b. Survey of Experiments Made.

The search has revealed no experiments made in shorthand to determine the interval of repetition, although a number of experiments have been made in psychological laboratories to determine the interval of repetition in general.

#### d. Specific Statement.

This experiment is undertaken for the purpose of trying to determine the relative effects of various intervals of repetition in shorthand.

## II. SELECTION OF A LABORATORY

### 1. Groups Chosen.

For this experiment it is suggested that beginners in shorthand be used, and since it is desired to find out how the matter works under actual conditions, all beginners could be admitted into the experiment.

### 2. Schools Chosen.

#### a. General Character of Student-body.

The investigation should be undertaken in as many schools as possible.

b. Accessibility.

The schools should be accessible to the experimenter, as explained on p. 36 ff.

c. Co-operation.

The necessary co-operation of all concerned should be assured, as per p. 38 ff.

3. Teachers Chosen.

The teacher in charge should be intelligent enough to handle the work. She should also have the proper attitude and interest, as explained on p. 41 ff.

### III. CHOICE OF CONDUCTOR

The teacher will most likely be the one chosen for the work, although anyone having the necessary qualifications could do it without injecting a disturbing element. The experiment will be conducted at the beginning of the subject, before the students have had an opportunity to become accustomed to any one teacher.

See also p. 44 ff. regarding this.

### IV. DEVELOPMENT OF A PROCEDURE

1. Content.

General Plan in Brief.

It would seem that the best way of obtaining our information is to have three sections, each being taught by the same teacher—one section receiving shorthand five times a week (Monday, Tuesday, Wednesday, Thursday, and Friday), another three times a week (Monday, Wednesday and Thursday) and the third section twice a week (say Monday and Thursday or Tuesday and Friday). We would map out a certain amount of the ground to be covered, working it out definitely by lessons. After a certain number of lessons, each section will be tested and the results of this test will be the basis of our judgment. The plan requires that the teacher give the same lesson to each section and cover the same amount of

ground in each lesson. She may find that she cannot cover the ground with one or two sections. If the sections had actually been equalized at the start, the trouble must be due to the interval—too much forgotten from last recitation that must be reviewed each time. It would seem wise in that event to take the section as fast as possible over the work, but no faster than the pupils can stand it, and then compare the ground covered at the expiration of the assigned number of lessons.

If a school can have only two sections, it would be better to have it tried on two than not at all.

An equalization test should be devised because of the many factors that constitute shorthand ability. In the absence of such a test, large numbers will have to be used to eliminate individualities.

The detailed instructions covering the procedure in the class room should be written. The essential things are:

1. That all sections should have the same teacher so that there is no varying factor in that respect.
2. That she should give the lesson to each section in as nearly the same manner as it is possible to give the same lesson to two different groups. We do not want any varying factor in the way the lessons are given nor in the quantity given at a lesson.

This leaves the teacher free to choose the method she thinks will best enable her to teach the class effectively.

Naturally, the section having the lessons five times a week will reach the goal much sooner than the others. At the time it does, it should be tested and the same thing should be done with each of the other sections. A school system may not feel like trying an experiment of this kind for a whole year. In that case a shorter period should be chosen and the sections re-united. This may also be done where a teacher may be willing to carry the extra burden for the time, but could not do it for a year. It would not be very hard work to equalize the sections so that they can be carried on as one class thereafter.

It has been said that a teacher could use her own methods in the class room. This is true, but at the same time the teacher should keep a record of her lesson plan so that in case the data is needed when the comparison is made, to shed light on any point, it will be available.

a. Difficulties.

Final test.

The final test will consist of a fair examination on the essential points covered up to that time. And these should be minimum essentials. The experimenter should be very careful to give a test that really tests the thing we are after, namely the student's grasp on shorthand. For instance, if it had been decided that the stopping point should be after the alphabet, circles, and loops had been learned, in the Pitman systems, then the student should be expected to know the alphabet; to know what the circles and loops represent; when to use the circles and loops, and when to use the stems; how to use them in connection with stems, i. e., where to place them on straight stems and where on curved stems. That would cover the minimum essentials and would seem to be a fair examination to test the attainment of the students to that point.

The results should be tabulated for each section, graphed, and compared.

They should also be compared with the results from other schools.

It may be that a teacher cannot cover the same work with all the sections. If that is so, a note should be made of it. It would help in determining the value of several intervals. It would indicate that the interval was too long and too much work had to be re-learned.

b. Time.

The dates of the beginning and end of the experiment should be definitely set, and of course, it will be decided on what days of the week the sections will meet.

c. Periods.

The periods should be so arranged that none of the sections will be at a disadvantage from fatigue or any other reason. See p. 56 ff.

d. Subject-matter.

The subject-matter will be the regular shorthand work of the school where the test is given. It will cover a certain portion of the subject like, for instance, the alphabet, or the alphabet, circles, loops, etc. The final test is to be given on the subject-matter covered and should be for minimum essentials only.

e. Details of Procedure.

No special instructions are necessary.



A record should be kept of all attendant circumstances, such as interruptions, weather, etc. See p. 59 ff.

2. Form.

The balance of the outline applies uniformly to all experiments and is covered fully on p. 62 ff.

b. SHORTHAND.

Experiment No. 5. A Method of Predetermining Those Unfit for High Speed in Shorthand.

1. FORMULATION

I. Introduction.

a. General Statement.

The object of this experiment is to help those schools which have a very high rate of speed in shorthand, as a requirement for graduation.

It is common knowledge that the average business man does not dictate rapidly, that his thoughts do not come to him quickly and that, therefore, in order to be of service in the business world, one does not absolutely require a speed of 100 words per minute.

In this experiment it is not the purpose to determine whether or not a person is unfit for a position as a stenographer. Any one of ordinary mentality, it would seem, ought to be able to acquire enough mastery of the principles of a shorthand system, to be able to take shorthand dictation fast enough so that he could do the work for the slowest dictator in the business world. Therefore, let us assume that every shorthand writer will be of some use to the business world, even though he may not be able to earn more than the minimum. But our schools are not satisfied to prepare students for the undesirable positions and, therefore, they have set a high standard for graduation, in many cases making it 100 or 125 words per minute.

It is to help decide beforehand, whether or not a person is capable of reaching this speed, that this experiment is undertaken. We would like to know, say, when a person begins to study shorthand, whether or not he will be able, so far as mental or psychologic equipment is concerned, to meet the requirements for graduation. Not that a person after reaching 80 words per minute finds that this is his limit and after spending two or

three years on the subject, finds that he cannot graduate in that course and must go out and seek a position without graduation. The person might have been able to equip himself for other work without the loss of time entailed, if he could have known sooner, that he could never reach the required speed of 100 words per minute.

This would seem to be a question of psychology rather than a question of methods of teaching, and therefore some psychologic test would seem to be the thing required.

If there is such a thing as a slow re-action to stimuli and this slow re-action is constantly uniform to all kinds of stimuli, it would be fair to assume that a test of any kind that would give the time necessary for the re-action, would be a proper basis for judging the re-action in the case of the dictation and taking it down in shorthand.

There may, however, be some varying factors, of which we know nothing, in this connection, and it would be better, therefore, to get as near the actual situation under consideration as possible—to take something that is actually shorthand work, actually dictation, if such a thing can be found.

Shorthand work is out of the question, because by the time the person is able to take it, he is very near the end of his course, and we desire to know the possibilities of a student at the time he wishes to take up the study of shorthand. Furthermore, the slow re-action in the case of writing shorthand may be due to other factors than a natural slow re-action. It may be due to not knowing the shorthand outline well enough, through non-application, etc.

Longhand dictation is therefore suggested. The essential thing is to have something with which the student is absolutely familiar, so that there may be no possibility of any hesitation on his part because he does not know the thing we want him to write. We desire to time his re-action to something he knows perfectly well.

Every student entering the high school should know the longhand alphabet. There would be no question on this score. Therefore the alphabet could be taken as material for the test.

We could approach more closely the actual situation in taking shorthand dictation, if we were to use a sentence containing words which should cause no hesitation on the part of any high school pupil; for instance, "The book was on the table in the other room."

The test will have to be undertaken individually or else there will have to be as many teachers as pupils. Of course, the first plan is more practical.

### b. Survey of Experiments Made.

The Search has revealed no experiments along this line.

### 2. Specific Statement.

This experiment is undertaken to try to find a method by which we can predetermine those who, because of their psychological make-up, are unfit for high speed in shorthand.

## II. SELECTION OF LABORATORY

### 1. Groups Chosen.

The test outlined is to be given to all pupils who are entering the shorthand classes, and is to be given as early as possible after entrance, or possibly before, if that can be arranged.

The reason for doing it early is so that, if the child does not measure up, he can be so told, and he will have an opportunity to change to another subject if he desires.

(The object is not to prohibit the student from taking shorthand, but to tell him, that, as far as we can tell, he can never attain a high speed in shorthand, and will likely not be able to graduate in the subject, and that if he does pursue it as his vocation, he will have to be satisfied with anything but first class positions. "Do you want to continue in the face of this or do you want to take up something else?" Of course, what has just been said is based upon our finding a test which actually does what we want it to do. Before we can talk so positively, however, we must have proved our case. If a student insists on taking the course, despite the indications from the test, record should be kept of the progress of the student to see whether or not the theory does carry out.)

As an experiment, the tests should be tried on the classes without telling them the reason. Record should be kept where neither the teachers nor the pupils can have access to it. At the end of the course these records should be compared with the progress the student has made, to see if the work of the student bears out the prediction. The object in keeping the record from the teachers is that no one may be able unduly to alter the outcome.

The reason for making every pupil take the test is that what might be a bright pupil in other subjects might not be one adapted to shorthand writing and possibly the judgment based on progress in other subjects, would

not be valid here. What might appear to be such a case has been found in the West Chester High School—a girl who is considered in the academic departments as being too bright to be in the commercial department, and yet she appears almost hopeless at times in her shorthand, and the teacher wonders if she will ever become an efficient stenographer.

Furthermore, if the test is given to all students at the beginning of the course in shorthand, the records can be compared with the ability of the pupils to take dictation at high speed and it will act as a check on the test and determine whether or not the test is dependable.

## 2. Schools Chosen.

### a. Character of Student Body.

This should be tried in as many schools as possible, so as to reach the greatest variety of students in order to be able to tell whether or not it really carries out under all conditions, and, if not, to try to ascertain under what conditions it does carry out and under which ones it does not.

### b. Accessibility.

The school should be accessible to the experimenter, as explained on p. 36 ff.

### c. Co-operation.

There should be the necessary co-operation on the part of all concerned as mentioned on p. 38 ff.

## 3. Teachers Chosen.

Since no actual teaching is involved in the experiment proper, there need be no thought given as to the teachers, unless the teacher is to conduct the test.

## III. CHOICE OF CONDUCTOR

The one who conducts the test, whether it be the teacher or the experimenter, should have the following qualifications:

He should know enough about psychology to be able to handle the situation intelligently and to appreciate unlooked-for situations that might

present themselves. He should also have had some experience in a psychological laboratory, so that he may be familiar with the methods of psychological tests, or he should have the necessary fitness that a person, who has taken such a course, would have.

He must have the scientific attitude of mind, be unbiased and be working only for the true solution of the problem and not be inclined to help matters one way or another. He must be exceedingly accurate because when we consider one-fifth of a second, it is an easy matter to make an error, and, since the time between high and low personal coefficients is not very great, the work must be accurately done. It is not a thing that anyone could do, and before the person hands in any results to be used as a record, he should do some practice work and, after he feels he has acquired a reasonable amount of skill in conducting the tests, he can then proceed with the commercial students, whose records are to figure in the experiment.

In short, the person selected should be some one who is posted on psychology, has had experience in a psychological laboratory, if possible, is keen, quick, observant and accurate.

See also p. 44 ff.

#### IV. DEVELOPMENT OF A PROCEDURE

##### General Plan.

In giving the test, the students would best be called in one at a time, and, after they have finished, they should be instructed not to tell the others what has taken place. Another person could do this instructing, in case the teacher wished to proceed as quickly as possible with the timing.

The student should be called up to the desk and given paper and pencil and told briefly that he is to write on the paper the letters and words that are dictated to him.

The question arises, should he be told any more than this, or not. It is not a test in spelling nor penmanship. Some students may think it is and lose time in that respect unless they are told. On the other hand, telling them that, may bring about an abnormal condition. If it is decided to test them on a sentence, all the words should be ones they know how to spell.

The hesitation in writing, which is the factor we are seeking, would take place if the student did not know how to spell a word, i. e., if he did not know how to begin it (for that is the only part with which we are concerned in this test). If he hesitated after he had started the word, it

would not make any material difference for our test, since we are noting the time when he begins to write. The penmanship, whether good or bad, would not count in the test, because all we are seeking is the time necessary to re-act and the moment the student touches the paper with the pencil, is the one with which we are concerned and nothing more than that. Therefore, it would not seem to be necessary to give any instructions at all except to write what he is told.

Should the student be instructed to write it as quickly as he can? The argument pro is, that he would be taking the test intelligently, that is, he would know what he is expected to do. The argument contra is, that it might produce a confusing element because he may try to go faster than he is able and get things wrong. Of course, in taking shorthand dictation, he knows he is to go as fast as he can, and yet similar trouble happens there, because the person, who tries to go faster than he is able, becomes confused.

The teacher, watch in hand, with his eyes on the pencil of the student, says the word or letter, and so saying, starts the stop watch. Just as soon as the student touches the paper with the pencil, in an attempt to write something, the watch is stopped.

This time should be noted on the record opposite the word dictated and under the name of the person taking the test.

So on with the rest of the words.

Ten words would seem to be a fair number on which to get an average. Add up the time required and divide by 10 to get the average.

After all the pupils have been tested, tabulate the averages.

#### 1. Content.

##### a. Difficulties.

#### Pre-preliminary Tests.

It may be necessary to do some pre-preliminary testing, to find suitable material for the preliminary test, and in order that the conductor may become acquainted with the method.

#### Preliminary Tests.

For the preliminary test the material will be either letters of the alphabet or a short sentence containing familiar words.

The following letters have been chosen as the best ones for pre-preliminary testing:

e, h, i, l, n, r, s, u, v, y.

They are the ones that can be made most quickly and do not have several variations, which would make it impossible to compare the time of one person with another (should we later find that necessary) because we could not figure on the extra time, and to tell a person to write an "a", for instance, different from his accustomed way, would introduce a factor which would be responsible for the hesitation.

Several students were timed for their re-action. It was explained to them that certain letters were going to be named and that they were to write them down just as fast as they could. No reason was given the student. The stop watch was started as soon as the word was said and stopped as soon as the student began to make the first stroke—just as soon as one could see the re-action take place. The following is the result:

| Student No. | 1   | 2   | 3  | 4  | 5  | 6  | 7   |
|-------------|-----|-----|----|----|----|----|-----|
| e           | 1   | 6   | 4  | 1  | 3½ | 3  | 4   |
| h           | 7   | 5½  | 4  | 5  | 3½ | 8  | 5   |
| i           | 1   | 6   | 5  | 1  | 4½ | 9  | 5   |
| l           | 5   | 5   | 3  | 4  | 4½ | 4  | 5   |
| n           | 5   | 3½  | 4  | 4  | 3½ | 7  | 5   |
| r           | 5   | 1   | 3  | 5½ | 4½ | 10 | 5   |
| s           | 4   | 4½  | 3  | 5½ | 4  | 5  | 5   |
| u           | 5   | 5½  | 4  | 4  | 1½ | 9  | 4   |
| v           | 4   | 5   | 5  | 4  | 4  | 6  | 5   |
| y           | 4½  | 3½  | 4  | 3  | 4½ | 5  | 3½  |
|             | —   | —   | —  | —  | —  | —  | —   |
|             | 47½ | 48½ | 39 | 43 | 41 | 66 | 46½ |

This time is given in fifths of a second.

From this table it will be noticed that the shortest average time is 3.9 while the longest is 6.6, very nearly twice that of the other.

On the basis of this table, would it be correct to assume that while the first person could re-act to an average of about 80 dictation stimuli per minute, the second could re-act to approximately not more than 50 per minute on the average? On its face, that would seem correct. It would be necessary to prove this, however, from actual cases tested both ways, that is, on the alphabet in longhand and also in shorthand dictation.

Several other students were also tested on the letters and, in addition, on a short, easy sentence. The sentence chosen was, "The book was on the table in the other room." No high school student should have to hesitate in writing any of these words, either because of the spelling or for any other reasons. The student was told that he would be given a sentence, one word at a time, and that he was to write the word as quickly as he could. The stop watch was started as soon as the word was pronounced, and stopped as soon as the pencil started the first stroke of the word. The following table shows the results:

|         | 1st attempt | 2nd attempt | 1st attempt | 2nd attempt | 1st attempt | 2nd attempt | 1st attempt | 2nd attempt | 1st attempt | 2nd attempt | 1st attempt | 2nd attempt                    | 1st attempt | 2nd attempt                    |
|---------|-------------|-------------|-------------|-------------|-------------|-------------|-------------|-------------|-------------|-------------|-------------|--------------------------------|-------------|--------------------------------|
| e       | 2           | 3           | 3           | 4           | 4           | 3           | 4           | 6           | 7           | 6           | 6           | 6                              | 5           | 6                              |
| h       | 4           | 2           | 4           | 4           | 4           | 3           | 6           | 5           | 5           | 7           | 5           | 4 <sup>1</sup> / <sub>2</sub>  | 5           | 6                              |
| i       | 4           | 3           | 5           | 4           | 3           | 2           | 4           | 5           | 8           | 4           | 6           | 6                              | 5           | 4                              |
| l       | 5           | 3           | 4           | 3           | 4           | 3           | 4           | 6           | 6           | 4           | 5           | 4                              | 7           | 4                              |
| n       | 4           | 3           | 4           | 3           | 4           | 3           | 6           | 6           | 6           | 4           | 6           | 4                              | 5           | 4                              |
| r       | 3           | 3           | 4           | 4           | 4           | 2           | 6           | 9           | 7           | 4           | 6           | 6                              | 8           | 6                              |
| s       | 4           | 3           | 4           | 4           | 4           | 2           | 5           | 6           | 7           | 4           | 4           | 4                              | 6           | 5                              |
| u       | 4           | 3           | 4           | 4           | 4           | 3           | 5           | 6           | 6           | 4           | 6           | 5                              | 5           | 4 <sup>1</sup> / <sub>2</sub>  |
| v       | 5           | 4           | 3           | 3           | 4           | 2           | 4           | 6           | 7           | 6           | 5           | 5                              | 5           | 6                              |
| y       | 4           | 4           | 4           | 4           | 3           | 2           | 5           | 6           | 6           | 4           | 6           | 4                              | 6           | 7                              |
| Total   | 39          | 31          | 39          | 37          | 38          | 25          | 49          | 61          | 65          | 47          | 55          | 48 <sup>1</sup> / <sub>2</sub> | 57          | 52 <sup>1</sup> / <sub>2</sub> |
| The     | 5           | 3           | 5           | 4           | 3           | 3           | 6           | 7           | 4           | 4           | 6           | 4 <sup>1</sup> / <sub>2</sub>  | 5           | 10                             |
| book    | 4           | 3           | 6           | 5           | 4           | 2           | 6           | 6           | 5           | 6           | 4           | 4 <sup>1</sup> / <sub>2</sub>  | 5           | 5                              |
| was     | 5           | 4           | 3           | 3           | 3           | 2           | 7           | 4           | 5           | 6           | 4           | 4                              | 7           | 6                              |
| on      | 5           | 4           | 3           | 2           | 2           | 2           | 7           | 6           | 6           | 4           | 4           | 5                              | 5           | 5                              |
| the     | 4           | 3           | 4           | 3           | 2           | 3           | 5           | 5           | 8           | 4           | 5           | 3 <sup>1</sup> / <sub>2</sub>  | 7           | 6                              |
| table   | 3           | 2           | 3           | 2           | 2           | 2           | 6           | 5           | 5           | 3           | 5           | 4 <sup>1</sup> / <sub>2</sub>  | 5           | 4 <sup>1</sup> / <sub>2</sub>  |
| in      | 4           | 3           | 3           | 2           | 3           | 2           | 6           | 6           | 5           | 5           | 7           | 4                              | 5           | 5                              |
| the     | 3           | 3           | 3           | 2           | 3           | 3           | 6           | 4           | 7           | 4           | 5           | 4                              | 5           | 4                              |
| other   | 5           | 3           | 1           | 3           | 2           | 3           | 6           | 8           | 5           | 4           | 5           | 4                              | 5           | 5                              |
| room    | 4           | 3           | 4           | 4           | 3           | 3           | 6           | 5           | 8           | 4           | 4           | 4                              | 8           | 6                              |
| Total   | 42          | 31          | 38          | 30          | 28          | 25          | 61          | 56          | 58          | 44          | 49          | 42                             | 58          | 57 <sup>1</sup> / <sub>2</sub> |
| Student | Sex         |             | Age         |             | Class       |             | Course      |             |             |             |             |                                |             |                                |
| 1       | F           |             | 17          |             | Senior      |             | Commercial  |             |             |             |             |                                |             |                                |
| 2       | M           |             | 17          |             | Senior      |             | Commercial  |             |             |             |             |                                |             |                                |
| 3       | M           |             | 16          |             | Senior      |             | Commercial  |             |             |             |             |                                |             |                                |
| 4       | M           |             | 17          |             | Fresh-Soph. |             | Commercial  |             |             |             |             |                                |             |                                |
| 5       | M           |             | 15          |             | Soph.       |             | Vocational  |             |             |             |             |                                |             |                                |
| 6       | M           |             | 15          |             | Fresh-Soph. |             | Commercial  |             |             |             |             |                                |             |                                |
| 7       | M           |             | 15          |             | Fresh-Soph. |             | Scientific  |             |             |             |             |                                |             |                                |

From these tables several things will be noted:

1st. that while there is a general uniformity, there is not absolute uniformity throughout. It is most likely similar to the situation in typewriting. We try to measure the speed of a person on the machine. Today he writes 40 net words per minute and tomorrow he writes only 20. Or it may be that 10 minutes after he has written 40, he writes only 30. There is considerable variation and yet in spite of it we gauge a person's value in typewriting, largely by speed. Why do we not give it up and find another method if this one is so varying? The fact of the matter is that the only way to ascertain what the speed of a person is, is to try him out. He may do better today than yesterday. He may do somewhat worse tomorrow. Nevertheless, it is more definite information than if we were merely to



guess at it. There are many factors which may enter into the test, which we cannot eliminate just at the time we want to do so, but we are at least enabled to say this much, that this person *has* written so many words per minute, just as we say that a certain horse has run a mile in so many minutes.

The table tells us at least that there is considerable difference between pupil No. 3, who in the second attempt averaged  $2\frac{1}{2}$  fifths of a second, and pupil No. 4, who averaged over  $5\frac{1}{2}$  fifths of a second in the 2nd attempt.

2nd, it shows that while some students re-acted in 2 fifths of a second at times, other students never made it in 2 fifths and never made it in less time than 4 fifths; see students Nos. 4 and 7. If this is their quickest reaction to something which they know as well as the long-hand alphabet and the easy sentence given, is their comparative re-action likely to be any quicker after learning a shorthand system, which we have good cause to believe they do not learn as thoroughly as they do their longhand alphabet? This would seem to be a logical conclusion, but the only way to prove it is to make the test and compare the finished product with the results of the test.

The value of some such test can readily be appreciated by commercial teachers, and it is hoped that other teachers will give some thought to the problem and try to find a better method than the one here suggested.

No equalization test need be given, because the object of this experiment is to ascertain a certain innate ability or lack of ability, which we believe we cannot equalize in any way.

#### Final Test.

The final test will consist in checking up the student's record at the end of his shorthand course with the record of the preliminary tests.

If the student has not survived until the end of his course, some effort ought to be made to ascertain the reason for his withdrawal. If he was one of those whose preliminary test showed a slow re-action and he could not make progress in his shorthand, this should be borne in mind in considering his record.

By ascertaining the slowest re-action of those who did complete their course, we will get some idea to help us over the troublesome middle ground. That is, we can easily agree that the quickest students would be fit and that the slowest would likely not be fit, but it would be difficult to tell about the others. If we have an accurate record covering several years' tests, we can say to students that so far no one of your re-action has made good, or that two or three of yours have made good. That will be another step in the direction of definiteness.

### Other Difficulties.

The greatest difficulty in this undertaking is that the most important factor, the time element, is measured by such exceedingly short periods. The difference between the students who can gain high speed in shorthand and those who cannot gain it must be very little in time required to re-act on each word or letter. But the sum of these for the period of one minute would be considerable. Since the difference in each case is so small, it will take keen observation and accurate work to obtain a record of the time. To overcome this difficulty, a stop watch is the instrument to use. Sometimes a watch loses a fraction of a second in starting, that is, it does not respond quickly enough to the touch in starting it. A watch that measures smaller periods than fifths of a second would be of considerable value in this experiment. There are instruments, of course, which measure smaller fractions of a second than fifths, but the price of these is prohibitive for the ordinary school, and we must try to find a method that can be used by the schools in general.

### b. Time.

The test could be given at any time convenient to the persons involved. It should be given at the beginning of the shorthand course if it is to be of much value.

### c. Periods.

There being no classwork in this experiment, we do not have to consider the matter of proper periods.

### d. Subject-matter.

The subject-matter of the tests should be material with which the students are absolutely familiar, so that there may be no hesitation due to anything else than innate ability to re-act.

All high school pupils are taken to know the longhand alphabet. It could therefore be used as suitable material.

The stenographer's test comes in taking words and not letters. A short sentence, containing familiar words, is therefore suggested as being better than letters. There may be no difference in these two, and again there may.

See p. 146 for suggested letters and p. 142 for a suggested sentence. Care should be used in pronouncing the "n" so that the student is not

obliged to pause in trying to determine whether "n" or "m" was said. Some students did not immediately understand the word "The" because the vowel was not pronounced as they were accustomed to hearing it. When a pupil hesitates in that way, a note should be made on the record, to help reconcile any differences.

It is suggested that both letters and sentences be used, as a check on each other.

It will be noticed from the table on p. 148 that there is some difference in the re-action between the first time the letters were given and the second time. This is likely due to the fact that the student does not know just exactly what is wanted the first time, on account of the novelty of the thing and the brief explanation given, and it would therefore seem wise to give each student two tests, one immediately following the other. This data may prove of value later on.

#### e. Details of Procedure.

(1) The instructions to the helpers should urge the greatest care to be accurate and to pronounce very distinctly.

(3) It would not make any material difference if the order of giving the letters is inverted, but it might cause some hesitation on the part of the student, if, in giving the sentence, the words are inverted, and the student, having been led to believe that a sentence would be given, stops to get sense out of something which does not make sense with inverted words. The brighter students would be the ones most likely to suffer on this account, as they would more quickly sense the fact that something is wrong and would hesitate because of it.

(4) Record should be made of any interruptions, misunderstandings, mispronunciations, etc., which would in any way affect the test. If it should happen that the student appearing for test is fatigued, the test should be given at another time, rather than give it and make note that he was fatigued.

If a word does not fairly represent the student's re-action because of misunderstanding, etc., it would seem that it should be thrown out in calculating the average. Misunderstandings will probably be the greatest factor accountable for variety in the recorded re-action time for a student, and where it is definitely known that the student has not had a fair opportunity, it seems wrong to include it. It will not always do to repeat the letter or word. That may produce too short an interval, on account of the student's half expecting it and being ready for it. Another letter could easily be substituted, but it is not so easy in the case of a sentence.

2. Form.

The balance of the outline applies uniformly to all the experiments and is covered fully on p. 62 ff.

b. SHORTHAND.

Experiment No. 6. Forearm vs. Finger Movement in Shorthand.

1. FORMULATION

1. Introduction.

a. General Statement.

Penmen have demonstrated the efficiency of the forearm movement in longhand over the finger movement. The question occurs: Does it also have a place in the writing of shorthand? Various opinions have been expressed when the question has been put to commercial teachers, as is shown by the following:

|                                       |   |
|---------------------------------------|---|
| Pitman writers who preferred forearm, | 1 |
| combined,                             | 2 |
| finger,                               | 5 |
| Gregg writers who preferred forearm,  | 6 |
| combined,                             | 4 |
| finger,                               | 2 |
| Graham writer who preferred combined, | 1 |

Several said that they did not know.  
Several others answered negatively that a certain one could not be used, but did not say which one could be used.

However, most of these are expression of opinion and those that are more than this are not supported by data in such a way that it would carry weight. Therefore, it would be well to try this out and see what could be done to obtain a scientific determination.

As will be noted, the Gregg writers claim that the forearm movement has a place in their system. Exercises for such practice, for use in the Gregg system, are published. The opinion, it will be noticed, however, is not unanimous.

Pitman writers do not think the forearm movement has so large a place in their system, their opinion being based, it is understood, on the fact that shading is required in the Pitman systems and not in the Gregg. If

the shading is the disadvantageous feature for forearm movement, what must we say about forearm movement for scroll work, engrossing, etc., of which we see considerable in penmanship magazines? If it is used to advantage for the shading in this kind of work, it might be used to advantage in shorthand.

b. Survey of Experiments Made.

No experiments along the line under consideration, have been found.

2. Specific Statement.

This experiment is undertaken to see if any light can be shed on the question as to whether or not the forearm movement would be of more advantage in writing shorthand than the present finger movement (or combination of movements).

## II. SELECTION OF LABORATORY

1. Groups Chosen.

It would seem that the experiment could be tried out on advanced pupils as well as beginners in shorthand. It ought not to be too late for the advanced student to "mend."

2. Schools Chosen.

Any school could be chosen where the conditions of necessary co-operation exist. See p. 38 ff.

3. Teachers Chosen.

What is said about teachers in general on p. 41 ff. also applies here.

## III. CHOICE OF CONDUCTOR

The regular shorthand teacher would seem to be the most suitable person to conduct the classes, provided she knows the subject of shorthand penmanship.

The general reasons given on p. 44 ff. also hold here.

## IV. DEVELOPMENT OF A PROCEDURE

## 1. Content.

## General Plan.

Inasmuch as the question of shorthand penmanship has been raised, it would seem worth while to decide the matter by obtaining some reliable data for the various systems of shorthand.

We can take either a beginners' class or an advanced class. We should have two sections of the class, one taking forearm penmanship work and the other practicing with finger movement, and at the end of a given time, results should be compared.

Or we may have only one section of advanced students, and compare the shorthand penmanship of the students before and after having had special forearm drill in the work.

Let us take a beginners' class, which will be divided into two sections. In addition to the regular work of the class, each section will have, say, 15 or 20 minutes on shorthand penmanship. In the one section they would practice shorthand marks with the finger movement, and in the other, with the forearm movement, both sections taking the same amount of practice (so far as time is concerned) and practicing on the same material. At the end of a month and again at the end of two months, we would give them a final test. This would be dictated at a fairly rapid rate, considering the advancement of the students, and they would be asked to write it in shorthand. The work in their final tests could then be compared with the work of the preliminary or equalization test.

Let us take an advanced class, which will be divided into two sections, both under the same teacher. The sections will be given 10 or 15 minutes of shorthand penmanship, one section forearm and the other finger movement. The results here may be different from those of the beginners because of the fact that these students are doing much more phrasing and the outlines are consequently longer. They should be tested on matter which is entirely familiar to them, and the test should be given at the speed which is the normal speed for the part of the course in which they are working. Then, a comparison of the papers should be made, as with the beginners.

## Preliminary Test.

Some test will have to be given at the start, whether it be a preliminary

test or an equalization test. If it is decided that an equalization test is necessary, we can use that test as a preliminary test also.

The purpose of the preliminary test is to have specimens of the shorthand penmanship taken at the beginning of the experiment, so that we can observe the progress made during the special shorthand drill.

The preliminary test should consist of writing in shorthand from dictation. Of course, the speed of the dictation must be gauged by the progress of the class. In the case of beginners we shall have to wait until they have learned the alphabet, at least.

#### Equalization Test.

Do we require an equalization test? If so, what nature shall it take?

We shall likely agree that the ability of all persons to do forearm movement in shorthand, is not alike, and therefore we will have to equalize the class in some way.

Contrary to many experiments, we do not want to get an equal number of each kind of student into each section. We are testing forearm writing and finger writing. The most logical thing to do, it would seem, would be to put the forearm writers into one section and the finger writers into the other. In this way each student is with his own clan and more co-operation will result than would be the case if some who never reconciled themselves to the forearm movement are put into that section. It would seem useless to put the forearm writers into the finger writing section and try to accustom them to this method. They would most likely unconsciously write with the forearm movement, and we would not be testing at all the thing we thought we were. Therefore, we must find some method of determining who the forearm writers are, and put them into the forearm section.

Possibly the best method of determining this would be to have the penmanship teacher observe the students in their writing and classify them.

If it is found that a considerable number of students use a combination of finger and forearm movement, it might be well to make a third section, and permit them to do their shorthand penmanship practice in line with this combined method.

#### Final Tests.

Monthly intervals between final tests would seem to be reasonable.

The test should be on matter familiar to the class, and should be given

at a speed which the class can take. The matter should be dictated. We do not want to give this test at too slow a speed, for that is not the way shorthand is taken, and, furthermore, it would permit the finger writers to draw their outlines, instead of writing them.

#### Other Difficulties.

Our one great difficulty will be the scoring of the papers.

We could quickly find our way out of the difficulty if we had a shorthand penmanship scale, similar to those we have for longhand penmanship. So far as the present research has shown, however, there is none. The only thing left for us to do in the absence of such a scale, is to separate the papers into three classes: excellent, poor, and mediocre. It will be easy to select from the class the most excellent ones and also the poorest ones, but those on the border line will give trouble. However, since we have no better method at present, we must use it. And, though it is not a closely graded method of classification, it is better than none at all.

One method of comparing preliminary with final tests, would be to see how many of the mediocre and poor class reached the excellent class and how many of the poor class reached the mediocre class.

Another method would be to compare each student's preliminary test with his final tests. This might be very convincing for the teacher who has the papers in front of her, but in the absence of a scale, it would be very hard for her to convey to others, who cannot see the papers, the amount of improvement that has taken place. We would be obliged to take her word that there was much or little improvement, and we would not get a very definite idea from it.

This experiment will be more convincing to the person making it, than it can be to others. But, even in spite of this disadvantage, it does seem worth while to undertake it. The papers of the preliminary and final tests should be kept on file, so that in case a shorthand penmanship scale is evolved, more definite information can be given, regarding the results.

#### b. Time.

The experiment could be tried practically any time of the year, after the beginners have learned at least their alphabet.

The penmanship work should come as often as the regular shorthand instruction is given. The easiest way to do would be to take part of the shorthand period for it, say 15 or 20 minutes.

The final test could be given at the end of one month, two months, or



more, if it were found that the results were sufficiently promising to warrant conducting the experiment for that length of time.

c. Periods.

Periods would not seem to make much difference. Penmanship does not require a large amount of concentration and would not be fatiguing. We ought to be sure, however, that one section does not have an advantage over the other in the choice of periods. See p. 56.

d. Subject-matter.

The subject-matter of the drills would be the shorthand characters which the students are using at their stage of advancement. For the beginners it would be largely alphabet and simply words. For the advanced students it would involve phrasing.

The tests should be on familiar matter.

e. Detail of Procedure.

No particular instructions need be given for this experiment. The general considerations mentioned on p. 58 ff., under this heading, would apply.

2. Form.

The balance of the outline applies uniformly to all experiments and is covered fully on p. 62 ff.

b. SHORTHAND.

Experiment No. 7. The drill most valuable to the shorthand student.

I. FORMULATION

1. Introduction.

a. General Statement.

This problem is similar to the one in spelling. We have reached the point where, instead of trying to learn the spelling of all the words of the dictionary, we select those that we think are the ones most frequently

used, and drill on them. It is unwise to try to give shorthand students all the words they may ever use. It would seem much wiser to drill them thoroughly on the words which they will use frequently.

In spelling, one man selects 100 Spelling Demons, another selects 542 words from 2000 miscellaneous letters, another selects words from 270 newspaper articles by 200 different writers, etc.

How shall we obtain the list for shorthand drill? That is our problem.

#### b. Survey of Experiments Made.

The search for experiments in this field brought none to light.

#### 2. Specific Statement.

This experiment is undertaken with the hope of helping to determine what phrases and words would afford the most valuable drill for the shorthand student.

This undertaking will be somewhat different from the other experiments, insofar as the greatest part of the work will not be done with classes. The material will be obtained from sources outside of the school. The only connection the school will have will be to prove or disprove, by the efficiency of its students, the value of the words and phrases selected.

### II. SELECTION OF LABORATORY

#### 1. Groups Chosen.

Any shorthand pupils could be used for the work.

#### 2. Schools Chosen.

Any schools would be suitable, where the necessary co-operation exists. See p. 38 ff.

#### 3. Teachers Chosen.

Any efficient shorthand teacher could be chosen. She should have both sections of the class. See p. 41 ff.

### III. CHOICE OF CONDUCTOR

Because the work will extend over a long period, the teacher of the class is the most suitable person to conduct the experiment. See p. 44 ff.

### IV. DEVELOPMENT OF A PROCEDURE

#### OBTAINING THE LIST.

It would seem that the words chosen should be from business letters.

Taking the dictation of business letters will be the most important work of the majority of stenographers, outside of the court stenographer, and he of course, is a finished product, as compared with the student we have in mind. Therefore, we can ignore him in this consideration.

It would be better, it would seem, to get actual letters from business, rather than compose them ourselves.

It would be well to get the permission of several establishments, like John Wanamaker, etc. (one of say each important kind), and for say a week, collect all the letters they write. Of course, permission would have to be obtained from these concerns, and the understanding would be that the person receiving the letters would keep strictly confidential any matter contained therein. If there should happen to be a personal letter or two written during the day, which were very confidential and of which the firm would not want the copy to leave the office, that copy could be omitted without affecting the work at all. It is the bulk of the regular work that we desire and not an occasional exceptional letter.

These letters could best be obtained by having the stenographer make an extra carbon copy. The co-operation of the stenographers would have to be enlisted, or else many of the carbons would not come through, or would be omitted in the making. That, however, is an easy matter to overcome. Possibly some check on the number of letters written a day by each stenographer, would assist. Possibly a posted record in the office, showing the number of letters turned out, would encourage care along the line desired. One stenographer would not want the other to beat him in the number of letters turned out, and, of course, if the record is made from the carbons turned in, it will be an incentive to the stenographers to make the extra carbon copy; otherwise, they will not be given credit for it on the efficiency list.

An efficiency competition could be instituted as a camouflage for the real reason for wanting the copies, and possibly something offered to the person who reaches the highest efficiency, if that is not becoming too mercenary. But that would be a matter for the concern to decide and would not affect the list at all, so long as carbon copies are obtained of all the letters written during the period.

The stenographers should not know the purpose of the carbons. It may not make a difference and again it may.

An efficiency contest could be instituted in several concerns over the city at the same time, and inter-firm competition started, if so desired.

Many firms might welcome this opportunity of ascertaining just how much work the various stenographers do.

From all the carbons obtained, the words could be listed and checked

off, putting a dot after the word for each time it occurs. Then those most frequently used could be made the basis of drill.

A list of the phrases used should also be made. Both lists should be utilized in the drill.

One awkward situation just at this time is the fact that we are trying to get our high school students away from the hackneyed phrases which have been used in business. We teach the pupils one thing in school, and yet when they get out into business they come into contact with a great number of older men who never learned Business English and who are still using the time-worn expressions and phrases. Some years hence, when the control of business is in the hands of the students at present in our high schools, who are being taught the better English, this difficulty will be overcome. At that time another list of words and phrases will be necessary.

#### GENERAL PLAN FOR TRYING OUT THE LIST.

After we have the list, we would have two sections of a class. The one section would be conducted just as it would be if no list were known. The other section would be drilled in the words and phrases in the list, as part of their regular shorthand work. Of course, that means time must be taken away from their regular work. In all other respects their work should be the same as that of the other section.

The final test should consist of typical business letters, given to both sections, at various speeds, say 100, 120, 140 or any other grading deemed wise. The object would be to see how many from each section could take correctly, the letters at the higher speeds.

##### Preliminary Test.

The equalization test will serve the purpose of a preliminary test.

##### Equalization Test.

If we are to use this list with beginning students in shorthand, we shall be obliged to equalize the class on the same basis mentioned in Experiment No. 4, p. 139; but since we have no satisfactory basis as present, we shall have to conduct the experiment on a large scale, to eliminate individual differences.

If we are going to begin using this list with advanced students, we are in position to have some idea as to their ability in shorthand, by the marks

they have made thus far in the subject. These may be subjective, to be sure, and the judgment of one teacher, but if we can subdivide the class of one teacher, it will not make so much difference. Each section should contain an equal number of the best of the class, as well as the poorest, etc.

A more objective basis could be obtained by giving the students a transcription test, in which no typographical errors are counted, but merely the errors due to the shorthand notes. A penalty should be imposed for every error, and the section could be formed on that basis.

#### Final Test.

As mentioned above, the final test should consist of taking from dictation say three typical business letters, one set being given at 100 words per minute, another set at a slightly higher speed and another at a still higher speed, etc. These should be letters that the students have not been practicing.

#### b. Time.

The drill will be given at the regular shorthand period for a part of that period, and will last over an extended time, possibly till the end of the course. That item can be determined better by the person who has the work in charge and has an opportunity to see how things are working out.

#### c. Periods.

The periods should be the regular shorthand periods. Care should be taken, however, in arranging the schedule, to see that one section is not at a disadvantage so far as fatigue is concerned, when it reports for its shorthand work. See p. 56 ff.

One teacher should have both sections.

#### d. Subject-matter.

Both sections will pursue the regular shorthand course; only one section will have drill on the list of words and phrases. Of course, this will mean that some other work must be omitted from the period. It is suggested that whatever drill has regularly been given to the classes be omitted for this section and that drill on the list of words and phrases

be substituted. If no drill had been given at all, and the class was simply conducted by taking dictation and reading back, there will have to be less dictation and reading back, to allow time for the drill.

The letters collected for the list would make good dictation material, if the consent of the firms could be obtained for that purpose. The regular dictation book used in the school should also be used for both sections.

e. Details of Procedure.

No particular instructions are necessary, except that the teacher try to keep as nearly uniform as possible the work of the two sections outside of the drill material.

If there are any interruptions at the time the final test is taken, note thereof should be made. See p. 59 ff.

2. Form.

The balance of the outline applies uniformly to all experiments and is covered fully on p. 62 ff.

c. BOOKKEEPING.

Experiment No. 1. Gradation in Mastery.

I. FORMULATION

1. Introduction.

a. General Statement.

In teaching a number of subjects there are two distinct methods followed by teachers. By the one method the pupil absolutely masters each step before he proceeds to the next. By the other, the pupil goes to the end of a stage and then the lost ends are picked up; in the review those things are cleared up which he did not understand.

Very often things resolve themselves not into a question of one method or the other, but of a combination of the two.

In the present case, consideration will be given to the following question: Is bookkeeping taught with better results by mastering step by step or by proceeding to the completion of a suitable section of the subject and then picking up lost ends?

### b. Survey of Experiments Made.

The search has revealed no experiments in the field of bookkeeping taking up the consideration of Gradation in Mastery.

### 2. Specific Statement.

This experiment is undertaken with the idea of trying to determine whether better results are obtained when each step in the study of bookkeeping is mastered before proceeding, or whether better results are obtained when each stage of the subject is taught without halting for absolute mastery of the steps, depending on the review to clear up those matters which any of the students did not grasp.

## II. SELECTION OF LABORATORY

### 1. Groups Chosen.

For this experiment beginning students in bookkeeping should be selected. The two methods would not apply to advanced bookkeeping, because that is more a matter of understanding how the rules are applied to the various lines of business and to concerns of different sizes.

It might be tried with pupils of the junior high school, of the regular high school, and of business schools.

The results in the different schools may show a difference, due to the maturity of the students.

### 2. Schools Chosen.

It may be that pupils of a certain type succeed better with one method than with the other. Therefore, the experiment should be tried on pupils of as many different types as possible; in each case, however, being very careful to note fully the type of pupil, so that if the results do not agree, we may look for some light in the different types and possibly find the principle that operates in this connection. For instance, possibly in a school where the students were chiefly born of illiterate Slavs or Russians, one method might work better than the same one would with a high type American home as the base. Children steeped with the German idea of thoroughness might advance more rapidly by thoroughly mastering every step. They may become absolutely confused if they do not master the preceding steps.

b. Accessibility.

The school should be accessible to the experimenter, as mentioned on p. 36 ff.

c. Co-operation.

The necessary co-operation should exist, as referred to on p. 38 ff.

3. Teacher Chosen.

The same teacher should have charge of both sections, so that the question of personality will not enter into the results. See p. 41 ff.

### III. CHOICE OF CONDUCTOR

As mentioned above, the regular teacher in charge of the class should be the conductor of the experiment. See p. 44 ff.

### IV. DEVELOPMENT OF A PROCEDURE

i. Content.

a. Difficulties.

Equalization Test.

No equalization test seems necessary. If we did give one, it would have to be a test in ability to do bookkeeping. By our hypothesis the students' knowledge of bookkeeping is nil, since we are to try the experiment on beginners.\* Therefore none of them will have any knowledge of bookkeeping except such as are repeaters, or at some other time have had bookkeeping. They, of course, must be eliminated from the records. They may take the work in the regular course with the others, and may even take the tests, but the results of their tests are not to be counted.

To balance any other factors which may cause inequality, the experiment will have to be conducted on a large scale.

Final Test.

The final test should be a fair test of the student's knowledge of bookkeeping up to a certain point. See p. 166.

A little time should elapse after the review before the final test is given.

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\*See p. 163.



Otherwise the matter might be too fresh in the minds of the students who just completed the review.

b. Time.

The experiment is to be conducted for such length of time as may be felt can be given to it. It will, at least, have to cover a particular section of the subject to the point where a review could profitably be given. If one section takes much longer than the other and does not get it as thoroughly by the tests, the first would seem to have the better method.

c. Periods.

The periods would be the regular ones of the class. Care should be taken to see that one section does not meet at a period when it is more fatigued than the other section. See p. 56 ff.

d. Subject-matter.

The subject-matter to be used for instruction and test would depend upon the part of bookkeeping to be covered.

The study of debits and credits for all kinds of transactions, entries being made in the journal, might be one phase.

In the one section, the general rule for debits and credits will be given and explained. Then, without stopping to master it, the class will proceed with the rule for debiting and crediting Cash, say, and then for Mdse., Personal Accounts, Interest, Discount, Expense, etc., all entries being made in the journal. (If the text book in use does not give this order, follow the text book).

In the other section, the general rule for debits and credits will be given and explained. The students will master it and will not proceed until the rule is thoroughly understood and mastered. (Complicated transactions should not be used). When that is done, the students will be given the rule for debiting and crediting Cash and will master it thoroughly. In the same way will be given the rule for Mdse., then for Personal Accounts, etc.

At the end of the time necessary for this, or at the end of the time available, both sections will be given the same test and the results will be compared. Of course, the test should be on the material that was being studied. For instance, a test might be given involving ten entries, including the following transactions: cash received, cash paid out, a debit or a

credit to a personal account, Mdse. purchased or sold both for cash and on account, etc.

In scoring the papers, the debits and the credits will be the important items. If the debit is correct, 1 point will be counted; if the credit is correct, 1 point will be counted.

The students will not be given any arithmetic in the tests. All the addition, subtraction, multiplication and division will be done for them because this is not a test in arithmetic and nothing which might be a disturbing factor should enter into the test. A student may understand the bookkeeping part of the transaction and yet not do his arithmetic correctly. He is not an efficient bookkeeper, to be sure, but that question is not to be decided by the test. The object of the test is to ascertain whether or not he knows the principles of bookkeeping—the debits and credits. There would be no sense in testing his arithmetic to get this information.

There should be an explanation written in the book as part of the entry, of course, but it is suggested that no account be taken of this in the scoring, for the reason that it was not emphasized in the work in mind. Furthermore, it applies to all entries alike, and if the student understands the transaction and knows what is called for in writing the explanation, there should be no trouble in getting that correct.

In choosing another phase of elementary bookkeeping, the study of the uses of the different books might be taken. For this, however, an equalization test would be necessary. Debits and credits must be understood for this work and it would be poor procedure to put into one section all those who thoroughly knew debiting and crediting, while the other section contained those students who did not know it so well. A test involving the knowledge of debits and credits should be given, and the sections formed on the basis of this test, putting an equal number of each grade of student into each section.

After the sections have been formed, the procedure would be as follows:

The use of the cash book would be explained, the sales book, the invoice book, etc.—whichever books the text gives and in the order given in the text.

In the one section each book would be mastered before proceeding to the next.

In the other section the plan would require going from one book to the next, without any delay, and, after all the ground has been covered, a review would be given to clear up the unsettled points.

When this has been done, a test would be given, which would consist of

a number of transactions covering the important kinds that have been studied. The student would be told to enter them properly in the respective books. Paper should be given the students, properly ruled and named, i. e., Cash Book, Salesbook, etc. (This would reduce the number of disturbing elements.) The transactions should not involve any arithmetic nor complicated wording that would give the student difficulty in understanding the transaction. We are trying to test the student's ability to make the proper entries in the proper books, for ordinary business transactions as they would occur in business. We are not trying to test his ability to work out puzzles, as is the practice of some of the text books. The transactions should be plainly stated so as not to inject any factors which will confuse the student.

In marking the papers, the following basis is suggested:

If the correct book is used, count 4 points, because that is the element on which the stress was laid.

If the correct account has been debited, count 1 point.

If the correct account has been credited, count 1 point.

If the student used the proper name of the account, for instance, John Smith, and put it on the wrong side of the cash book, it would seem as though we should count one right and one wrong. His mistake was in the cash part of the transaction. The John Smith part was made correctly. It was put on the wrong side. Many students are taught to decide on what side of the Cash Book to make the entry, and then to enter the name of the other account. Unless special emphasis was laid on handling this as two separate entries (a Dr. and a Cr.), we can hardly count both wrong.

The explanation, written in the explanation column, will also give us trouble. It does not seem proper, for the purpose of the test, to count this.

First, because many students consider it the least important part of the entry, and so possibly it is. Because they consider it thus, it is the last thing they write and the one to which they give least thought. They are particular about the amount, the Dr., the Cr., and the date.

Because they give it so little thought, the entry does not always indicate what they know about it.

We are searching for what the student knows, and this item is likely to make us more trouble in this respect than it is worth.

It is a part of every entry, and when the student once understands it thoroughly, there should be no trouble in his applying it to any transaction whatever. Whereas, suppose he does not understand the principle back of the explanation, and gets it wrong in every one of the ten transactions given in the test, he is penalized ten times for a single item, which makes his record look worse than it is. It does not mean that his knowledge of bookkeeping is ten times less than the boy who got one Dr. wrong. They both missed in one particular, but in the case of the one student that one particular was repeated ten times.

Furthermore, consider an entry like this: an entry is properly made on the credit side of the Cash Book except that the explanation reads "Received on account." whereas the money was "Paid on account." The manner in which the student has handled his other receipts and expenditures shows that he understands how to handle the matter, but that this was merely a slip. He unthinkingly puts down something that he does not intend.

If it is decided to count the explanations, then our next difficulty is, how are we going to count this one?

We are convinced that the student knows how to make the entry. If we are trying by our test to ascertain what he knows, there is only one thing to do. We are satisfied he knows it and we must, therefore, count it right.

But the paper does not show his knowledge in that particular instance, though it does in some others. If we count it right for him, there may be others who should also be counted right, if we knew the facts. Here is the flaw of our present method for testing students, and it may be responsible for a great many discrepancies in the results of experiments in Education.

However, we are more concerned with obtaining a record of facts as they exist than with scrupulously adhering to any method of marking, which in reality is simply thought to be a means to an end. If we know this one instance where the paper does not show facts, we should count it correct, for then our marks will be at least one point nearer the true state of affairs than they would be if we marked according to the traditional manner.

All this argument can be avoided by simply paying no attention to the Explanation Column in marking the test papers. The student should know it to be a proficient bookkeeper, but because of the nature of the thing, it does not concern us in the tests for this experiment.

e. Details of Procedure.

In the instructions given to the teachers, the method of marking the papers should be clearly explained, as well as the method of conducting the classes.

If it is found that one section is slower than the other in covering the ground mapped out, the time limit will have to be extended for the slow section. It would then be a question as to whether or not the slow section understands the work more thoroughly. The tests should tell.

For interruptions, etc., see p. 59 ff.

2. Form.

The balance of the outline applies uniformly to all experiments and is covered fully on p. 62 ff.

c. BOOKKEEPING.

Experiment No. 2. Use of Suggesters.

I. FORMULATION

1. Introduction.

a. General Statement.

Dr. A. Duncan Yocum, Professor of Educational Research at the University of Pennsylvania, has for some time believed that much would be gained by the pupil if he were helped in his work by the use of suggesters.

By "suggesters" Dr. Yocum means some main topics—three or four or five, not many—in any subject, around which the student can organize the material both in studying and in recalling. The topics must be broad enough so that they can carry through the greater part of the subject, at least.

For instance, in Commercial Geography, there are four main topics which the student should have in mind when studying the subject, and each time he comes to the consideration of a new country, he should look for this information, namely:

1. Natural advantages or disadvantages
2. Production
3. Manufactures
4. Transportation

He should group his information around them and thus get good interconnection for re-call.

When being tested on the subject, he can use these suggesters for an outline, about which to organize his material. It gives the student something definite, about which to arrange and group his thoughts.

From experiments already tried in other fields it is shown that this is a better method than the old way. Dr. Yocum would like to have the theory tried out in as many fields as possible.

In bookkeeping the use of suggesters would seem to be of considerable advantage and to ascertain this definitely this experiment is undertaken.

#### b. Survey of Experiments Made.

No record has been found of the use of suggesters outside of the group attending Dr. Yocum's Seminar.

A list of the experiments conducted along this line is given by Dr. Yocum in his article "The Most Immediate Concern of Educational Research During the Struggle for Democracy," which appeared in "School and Society," Vol. VII, No. 163, pp. 151-156, Feb. 9, 1918, as follows:

Experiment by Saml. L. Chew

- " " A. S. Martin, using suggesters for a manufacturing city
- " " P. A. Boyer
- " " R. F. Stevens, using suggesters for mechanical powers in high school physics
- " " Dowett Sondberg, using suggesters for climate
- " " Wm. J. Lowry, using suggesters for the topic Progress in Useful Arts
- " " Mrs. Scott Anderson, using suggesters in the kindergarten

#### c. Differentiation.

The same general plan which was used in the above-named experiments will be used in the present one.

#### 2. Specific Statement.

This experiment is undertaken to try to determine whether or not the use of suggesters in the study of bookkeeping would make for efficiency.

## II. SELECTION OF LABORATORY

#### 1. Groups Chosen.

The pupils chosen for this experiment should be beginners in bookkeeping, although suggesters could also be found for the use of some-

what advanced students, as, for instance, suggesters covering the study of notes and drafts.

## 2. Schools Chosen.

It would be well to try this in as many schools as possible. See p. 35 ff.

## 3. Teachers Chosen.

There will be two sections of each class and one teacher will be in charge. She must be a teacher capable of handling two different methods for the same subject, and must be willing to go to the extra trouble of becoming acquainted with the suggesters herself.

She must also meet the general requirements laid down on p. 41 ff.

# III. CHOICE OF CONDUCTOR

The regular teacher would be the most likely person for conducting the work, as she is familiar with the pupils and the work extends over too long a period to have a strange person take it.

See p. 44 ff.

# IV. DEVELOPMENT OF A PROCEDURE

## 1. Content.

### a. Difficulties.

### Equalization Test.

Two sections of the class are necessary and they will have to be equalized.

First, we must eliminate all those who have had bookkeeping in any form or quantity. Of course, if there are any in the class who do not understand English well enough, they must also be eliminated from the results.

The remaining ones will then form the group to be used in the experiment.

The knowledge of bookkeeping possessed by the students is nil, by our hypothesis.

Their ability to do bookkeeping should be tested, but we have no test

for that purpose. It would take considerable time to procure one. It would be necessary first to devise a suitable test, and then to try it out for a few years, to see whether it really is practical.

Under these conditions, the only thing that can be done, after eliminating those with previous knowledge of the subject, is to have the experiment tried on such a large scale that the individual differences will be absorbed.

#### Final Test.

The final test should be on material that was covered in the work, and should be marked on the basis of bookkeeping only. See p. 173.

#### b. Time.

The work will be done at the time assigned for the regular bookkeeping classes. It is difficult to say what the duration of the experiment should be. The chief difficulty is that if too long a time is taken to cover a subject, there will have been so much time that both sections could not help but get the subject-matter. A method that is more efficient does not show forth in that case. The outline of suggesters given is one that practically covers elementary bookkeeping. It might be desirable to give a test after the debits and credits are learned, one after posting has been learned, and another after closing has been learned.

If it is found that the section using the suggesters can proceed more rapidly than the other, and comes out just as well in the tests, that would be a point in favor of the suggesters.

#### c. Periods.

The periods should be the regular bookkeeping periods. Neither section should be at a disadvantage on account of fatigue, etc., as explained on p. 56 ff.

#### d. Subject-matter.

The subject-matter will be the regular bookkeeping work of the class. One section will follow it just as the work of the class would have been carried on had nothing been known of suggesters.

The other section will be given the suggesters and will be drilled in their use in connection with their regular work. This section must be told not to give their suggesters to the other section or to even mention them to the other pupils.

The suggesters should be in the hands of the students. They may copy



them from the board or mimeographed copies may be handed to them. The students should have the suggesters before them whenever doing bookkeeping and should make constant use of them. The suggesters should be impressed upon the minds of the students as much as possible. The lesson should be explained in the light of the suggesters and the answers should be called for in the light of the suggesters. They should be hammered home so that the pupils cannot help but think in terms of them.

The following suggesters could be used with beginners in bookkeeping:  
For work in books of original entry:

In considering the entry for a transaction,

Decide: WHAT BOOK  
      WHAT DR.  
      WHAT CR.

Then make the entry, adding amount, date, explanation.

In POSTING, we must learn

      WHEN to post

      WHAT to post

      HOW to post, i. e., whether it goes to Dr. or Cr. side.

In CLOSING or ruling off, we must learn

      WHAT i. e., which accounts, to close

      WHEN i. e., at what periods, (Personal Accts. whenever they balance, etc.)

      HOW i. e., which columns to rule off, which single and which double.

The words in capitals are the suggesters. The rest is simply added by way of explanation and to show how the words are interpreted. The whole scheme should be given to the class, but the suggesters are the words that should be emphasized and drilled on.

The following scheme for marking the test papers is suggested:

Book, if it is in the proper book, give the student 1 point

Dr., if the proper account is debited, give the student 1 point

Cr., if the proper account is credited, give the student 1 point

Entry, if the entry is correctly made so far as date, amount, and explanation is concerned, give the student 1 point

      If any of these three parts of the entry is lacking, give 0

In Posting.

      When, if answered correctly, give the student 1 point

      How, if posted to proper side, give the student 1 point

      What, if amount, date, and postmarking are correct, give the student 1 point

In closing.

What, if the correct account is closed, give 1 point

When, if it is closed at proper time, give 1 point

How, if the ruling is properly done, and amounts put in where they belong, give 1 point

(The question arises, shall we count the addition in considering the amounts, or simply the place where the amounts are put? It is suggested that the addition be disregarded for the purpose of this test.)

e. Details of Procedure.

The instructions to the teachers should contain a caution regarding the care that must be used lest the methods be mixed and the suggesters be used with the section that is not to have them.

The suggesters must be kept from the section not supposed to use them. This may prove a difficult thing in some places. It did not prove so when tried out in West Chester, Pa. The teacher will have to use her ingenuity to meet this situation. If it does happen that the suggesters do get into the hands of the wrong section, a note of the fact should be made in the report. A good plan would be for each section to keep from the other, the work they are doing.

Record of interruptions, during test, should be made, etc. See p. 59 ff.

2. Form.

The balance of the outline applies uniformly to all experiments and is covered fully on p. 62 ff.

c. BOOKKEEPING

Experiment No. 3. The Use of Forms in Bookkeeping Compared with the Use of Text Book Only.

I. FORMULATION

1. Introduction.

a. General Statement.

As one takes up a bookkeeping text book, he will often find in the preface, a statement to the effect that the book is so arranged that it can be used with or without the forms. By "forms" it means handling the actual papers that would be used in business. For instance, if the trans-

action is one which involved the receiving of money, the student will actually receive the money (a slip of paper about the size of a regular greenback, printed somewhat after the fashion of our government greenbacks) or he may actually receive the check, as the case may be. If it is a Notes Receivable transaction, he will actually handle the note referred to, etc.

The inexperienced teacher asks, "Which is the better method?" Some teacher of experience will say, "I have found that the method of using the forms is by far better." It is merely her opinion, at best based upon observation, more or less accurate. Some teacher may actually have tested out both methods, but in the present investigation no record of any has been found. Therefore, it might be well to have some on record, and with this in mind, the following experiment is undertaken.

#### b. Survey of Experiments Made.

No experiments along the line under consideration have been disclosed.

#### 2. Specific Statement.

This experiment is undertaken to try to determine whether or not the use of forms in bookkeeping in connection with the text book is better than simply using the text without the forms. By "better" is meant giving a more thorough understanding of transactions and bookkeeping.

## II. SELECTION OF LABORATORY

#### 1. Groups Chosen.

Any beginners in bookkeeping would be suitable pupils for this experiment. There should be two sections, one using the forms and one not using them.

The methods should be tried on pupils in the junior high school. The more concrete method might work better with the younger students.

#### 2. Schools Chosen.

Any schools having the necessary conditions for co-operation, etc., would answer the purpose. See p. 35 ff.

#### 3. Teachers Chosen.

One teacher should be in charge of both sections of a class. Any teacher meeting the requirements set forth on p. 41 ff. could undertake the work.

### III. DEVELOPMENT OF PROCEDURE

#### I. Content.

##### General Plan.

There should be two sections (both under the same teacher), one using the forms in connection with the text, and the other using the text book only.

It will be necessary to equalize the sections in some way, or conduct the experiment on a large scale.

The instruction given by the teacher should be the same for both sections. Of course, good pedagogy would require that when she explains checks or notes, etc., she have in her hand a paper of the kind that she is explaining, no matter which section of the class is before her. The same explanation must be given to both sections.

A final test would be given on the work covered and this would be used as to the basis of determining the value of the two methods.

The likelihood is that the section not using the forms will cover a certain amount of ground in less time than the other section. We cannot permit both the time element and the ground covered, to vary. It would be easier from the standpoint of making out the test, to have both sections cover a certain amount of ground and take the test as soon as they have finished it. If the one section completes the work first and makes a better showing in the test, we shall have to hand the palm to that method. If the slower method shows the better percentage in the test, it will show that these students understand the work more thoroughly. Of course, not much importance should be attached to the results of one experiment. The matter should be tested out in several places, and if it is found that the results are uniformly alike, we can speak with some authority. There may be a number of unknown factors hidden beneath one experiment, which may not be brought to light until the work is tried again.

#### a. Difficulties.

##### Equalization Test.

In the matter of equalization test, it will be necessary to follow the same plan as in the preceding experiment, p. 171.

#### Final Test.

At the completion of the assigned work, a final test will be given to each section. The test should be based on the subject-matter as far as the class has covered it, and should be straight bookkeeping. The transactions should be simply stated because that is the way most of them occur in business.

Complexly worded transactions should have no place in this work. To confuse the student in the wording, is not testing his knowledge of the way to handle the transaction itself. It is testing his ability to understand the transaction, not his ability to make the entry for it. He must understand the transaction before he can make the proper entry, and if he is not given a fair chance to understand it, it is not correct to charge that against his knowledge of bookkeeping.

As little arithmetic should be required of the student as possible. Time is saved, and in a given period we can test more of his actual bookkeeping knowledge, if he is not obliged to use up the time by doing arithmetic. To obtain his cash balance, however, and similar items, he will have to add the columns himself. That is a thing we cannot do for him. The use of round figures will help greatly.

Properly ruled paper would also help to expedite matters. One need not necessarily mark the paper to show what book it represents, but it would save time to merely have the paper ruled and given to the pupils. The pupil can then choose the kind he believes should be used.

In marking the final test, the following method is suggested:

- If the transaction is entered in the proper book, count 1 point.
- If the proper account is debited, count 1 point.
- If the proper account is credited, count 1 point.
- If the amount is correct, count 1 point.
- If the explanation is put in the proper place and answers the purpose, count 1 point.
- If the general form of the entry is correct, i. e., if the date is in the proper place, explanation in the proper place, debits and credits and amounts in the proper places, with respect to columns, margins, indentations, etc., count 1 point.

It will be noted that no count is given for neatness, penmanship, etc. Some teachers mark heavily for these items in grading bookkeeping. They are necessary for a good bookkeeper but for the purpose of the experiment they may be ignored.

b. Time.

The work would take place during the regular recitation periods for bookkeeping.

The test would be given each section as it finished the work to be done.

c. Periods.

The regular periods would answer if in line with the suggestions set forth on p. 56 ff.

d. Subject-matter.

The subject-matter would be the regular bookkeeping work of the text book covered by the pages assigned.

The final test would be straight bookkeeping taken from the ground covered. See p. 177 ff.

e. Details of Procedure.

The instructions to the teachers should urge caution to see that none of the work is done outside of the regular bookkeeping periods.

Record should be made of disturbances, weather, etc., during both the regular class periods and the test periods, as mentioned on p. 59 ff.

2. Form.

The balance of the outline applies uniformly to all experiments and is covered fully on p. 62 ff.

## APPENDIX

A summary of the International Typewriting Rules covering errors and the marking of papers, is given as follows:

All writing should be double space on legal size paper.

The marginal stops should be set so as to make the writing line seventy spaces long.

Paragraphing may be done with an indentation of five or ten spaces, but must be uniform throughout the work.

In all matter which is rewritten, the first writing only will be considered, the rewritten matter being penalized as an error.

For every error named below, \*Five Words will be deducted from the total number written:

Striking wrong letter.

Improper spacing.

Omission of word .

Transposition of words or letters.

Piling letters at the end of line, or elsewhere.

Failure to commence line at starting point.

Deviation from copy in punctuation, paragraphing, capitalization, etc.

Inclined margin, caused by improper insertion of paper.

Faulty use of shift key.

Undue margin at bottom of sheet.

But one error shall be counted in any one word.

### SUGGESTIONS FOR MARKING PAPERS

When counting figures a word is allowed for each group of three figures—50,000 is counted two words.

When several words are omitted, each omitted word should be counted an error.

When a line or sentence is rewritten, the first writing only is counted, but the rewritten matter should be penalized as one error, whether it be a word, a line, or a paragraph. It is considered that the time consumed in rewriting is sufficient penalty. If, however, the rewritten matter itself contains errors, these should be counted.

The student cannot correct an error by striking one letter over another. All such cases should be penalized.

Either two or three hyphens should be used to indicate a dash, never one, even if spaces are left on each side of it. All dashes must be uniform throughout.

Compounded words are counted as many words as are in the compound.

Paragraphs may be indicated by either five or ten spaces, but the number must be uniform throughout the work.

Either two or three spaces may be made after a period, but the work must be uniform throughout in this respect: similarly either two spaces or one may be used after an interrogation point or an exclamation point according to the habit of the operator—but it must be uniform throughout.

When words are transposed only one error should be marked, as but one word is out of place.

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\*Increased to ten in 1918 (or 17).

Words improperly divided at the end of the line should be penalized.

Both insertion and omission of punctuation points are errors, but where a word and a following punctuation point are both omitted, only one error is counted, the point being treated as part of the word.

TABLE SHOWING THE VARIABILITY OF PERFORMANCE IN TYPEWRITING TESTS

Figures given are the number of words, gross and net, written in ten minutes. The same copy matter was used each time.

| Student | 1st Test |     | 2nd Test |     | 3rd Test |     | 4th Test |     |
|---------|----------|-----|----------|-----|----------|-----|----------|-----|
|         | gr.      | net | gr.      | net | gr.      | net | gr.      | net |
| A       | 518      | 348 | 529      | 479 | 564      | 504 | 551      | 451 |
| B       | 467      | 347 | 469      | 389 | 476      | 406 | 409      | 319 |
| C       | 540      | 430 | 550      | 430 | 545      | 435 |          |     |
| D       | 500      | 400 | 471      | 261 | 502      | 342 | 494      | 214 |
| E       | 448      | 378 | 458      | 388 |          |     | 479      | 419 |
| F       | 419      | 219 | 412      | 112 | 416      | 331 | 429      | 259 |
| G       | 506      | 305 | 541      | 281 | 492      | 362 |          |     |
| H       | 527      | 487 | 509      | 459 | 529      | 459 |          |     |
| I       | 564      | 134 | 572      | 452 | 583      | 463 |          |     |
| J       | 444      | 354 | 438      | 358 | 460      | 400 | 436      | 346 |
| K       | 533      | 192 | 488      | 138 | 547      | 377 | 524      | 346 |
| L       | 519      | 300 | 502      | 72  | 511      | 321 | 520      | 250 |
| M       | 458      | 318 | 394      | 154 | 459      | 329 | 484      | 374 |
| N       | 477      | 357 | 430      | 300 | 518      | 428 | 402      | 312 |
| O       | 407      | 217 | 430      | 310 | 434      | 344 | 447      | 347 |
| P       | 492      | 302 | 506      | 336 | 491      | 351 |          |     |
| Q       | 427      | 257 | 466      | 356 | 433      | 293 | 444      | 254 |
| R       | 495      | 345 | 398      | 368 | 499      | 410 | 526      | 116 |
| S       | 507      | 427 | 525      | 425 | 525      | 425 | 550      | 450 |
| T       | 474      | 323 | 451      | 221 |          |     | 500      | 260 |
| U       | 497      | 427 | 527      | 397 | 531      | 461 | 520      | 490 |
| V       | 484      | 414 | 469      | 369 | 485      | 405 | 513      | 353 |
| W       | 418      | 368 | 448      | 408 |          |     | 453      | 393 |
| X       | 489      | 419 | 486      | 336 | 523      | 483 | 498      | 408 |
| Y       | 528      | 238 | 509      | 349 | 500      | 280 | 512      | 232 |
| Z       | 549      | 359 | 532      | 352 | 520      | 420 | 553      | 323 |
| AA      | 370      | 270 | 380      | 190 |          |     | 387      | 337 |
| AB      | 465      | 395 | 513      | 443 |          |     |          |     |
| AC      | 439      | 379 | 452      | 372 |          |     |          |     |
| AD      | 469      | 380 | 469      | 420 | 500      | 410 | 495      | 420 |

The first test was given at 10:09 one school morning. The day was a dreary, rainy one. Temperature was 70.

The second test was given 10:22 the same morning.

The third test was given the day following, at 10:09 A. M. It was a bright sunny day. Temperature 70.

The fourth test was given the next day at 10:10 A. M. It was also a bright sunny day, with temperature at 70.

To ascertain whether there was any uniformity in the length of the words used in the International Typewriting Contest copy matter, several pages were picked at random and were typewritten. Legal paper was



used, a line was drawn the length of the paper at each margin, and the words were written as close to the margin as possible. Paragraphs were disregarded, so as to get a solid block of typewriting. The count was taken at the end of the 33rd line, which happened to be the last on the sheet. The result was as follows:

|         |     |       |
|---------|-----|-------|
| Page a, | 488 | words |
| b,      | 492 | "     |
| c,      | 474 | "     |
| d,      | 497 | "     |
| e,      | 494 | "     |
| f,      | 492 | "     |
| g,      | 484 | "     |

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